Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
FLEXIBILITY FOR DELIVERY OF COMMUNICATIONS BY MOBILE SATELLITE SERVICE PROVIDERS IN THE 2 GHZ BAND, THE L-BAND, AND THE 1.6/2.4 GHZ BAND	)	IB Docket No. 01-185
	)	
AMENDMENT OF SECTION 2.106 OF THE COMMISSION'S RULES TO ALLOCATE SPECTRUM AT 2 GHZ FOR USE BY THE MOBILE SATELLITE SERVICE	)	ET Docket No. 95-18
	)	

COMMENTS OF NEW ICO GLOBAL COMMUNICATIONS

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SUMMARY OF ARGUMENT

New ICO Global Communications (Holdings) Ltd. ("New ICO") strongly supports the Commission's proposal to amend the 2 GHz service rules to permit 2 GHz Mobile Satellite Service operators to incorporate "ancillary terrestrial components," or "ATCs," into their MSS networks. The proposal to permit fully integrated ATCs is the most direct and most efficient way to promote the Commission's policy goals relating to rural service, spectrum efficiency, and spectrum flexibility. New ICO opposes the alternative proposal in the NPRM (to create new stand-alone terrestrial licenses using MSS spectrum throughout the MSS license area), on the ground that it would be impractical, inefficient, and ineffective in advancing the Commission's policy goals, and would eviscerate the MSS licenses granted as recently as three months ago.

In these comments, New ICO addresses both the primary ATC proposal and the alternative proposal, and sets forth why the primary ATC proposal is clearly superior.

In Part I, New ICO applauds and endorses the Commission's reaffirmation that it is committed to the provision of broadband communications in high-cost rural areas, and argues that MSS is virtually the only way to provide high-quality mobile voice and data communications to rural as well as urban users. A revitalized MSS industry is virtually the only economically and technically efficient way to bring broadband service to rural Americans, and will arm public safety, military, maritime, and recreational users with primary redundant communications services that are even more essential in today's environment. Moreover, it achieves all of this without universal service subsidies.

In Part II, New ICO sets forth the ways in which the integrated ATC proposal will improve MSS networks and ensure their vitality. Integrated ATCs will remedy the urban signal problem that has plagued first-generation MSS networks and will make innovative advanced data applications possible for the first time. New services and improved urban coverage will expand the market for MSS offerings and will stimulate further investment in MSS products, including handsets and personal repeaters. Unlike current dual-band roaming arrangements, integrated ATCs will promote efficient use of MSS spectrum. .

In Part III, New ICO discusses the advantages of the integrated ATC proposal in terms of the Commission's policy in favor of spectrum flexibility. The flexibility required to implement integrated ATCs is similar to the Commission's treatment of other services, including the Direct Broadcast Satellite service, the Instructional Fixed Television Service, the Satellite Digital Audio Radio Service, the Multipoint Distribution Service, the Commercial Mobile Radio Service, and digital television broadcasters.

Part IV outlines the numerous technical and legal defects associated with the alternative proposal for a stand-alone terrestrial service using MSS frequencies. The problems with this proposal are almost too numerous to summarize, but they include the following:

- The alternative proposal would not remedy the urban MSS signal problem that is at the core of this rulemaking, and would therefore fail to promote rural deployment or the development of new services.
- The alternative proposal would not promote spectrum flexibility or spectrum efficiency.
- The alternative proposal would essentially eviscerate the 2 GHz MSS licenses granted as recently as three months ago.
- The alternative proposal would abruptly reverse ten years of U.S. leadership toward a global allocation for MSS at 2 GHz, leaving the allocation in tatters.

- The alternative proposal could not legally lead to the creation of an auctionable service.

In Parts V and VI, New ICO expresses its support for substantially all of the Commission's proposed service rule changes, but urges the Commission to remain faithful to the logic of its primary proposal: MSS networks that incorporate ATCs will always and everywhere be providing MSS, not terrestrial mobile service. Accordingly, an MSS operator's authority to provide service should not be any different for the ATCs than for the satellite component of the network. New ICO also supports the Commission's proposal to add a footnote to the U.S. Table of Allocations facilitating ATCs, but not to add any new primary allocations.

In Part VII, New ICO explains that with the addition of a single TIA technical standard for assessing interference, the integrated ATC proposal is entirely consistent with the Commission's existing 2 GHz relocation rules.

Adoption of the primary proposal to permit fully integrated ATCs will free up the MSS industry to use MSS spectrum -- spectrum already licensed to specific companies -- to achieve important policy goals like rural deployment and the development of new advanced services. The primary proposal will also further the Commission's broad policy preference for greater spectrum flexibility, and will show that knotty problems like the lack of digital networks in rural America can indeed be addressed without complicated regulatory regimes for cross-subsidization. The other option is for the Commission to side with incumbent terrestrial mobile operators -- against flexibility, against rural service, and against the innovations that will certainly come with the arrival of a truly ubiquitous digital network.

In making this choice, the Commission must be guided by the law and the public interest, and on these grounds the better choice is quite clear. The Commission should adopt the primary ATC proposal, using the proposed rules set forth in Appendix C, and should do so promptly.

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COMMENTS OF
NEW ICO GLOBAL COMMUNICATIONS

This proceeding[1] presents the FCC with an extraordinary opportunity to achieve simultaneously a number of important policy goals. The Commission can promote the deployment of advanced services to mobile users from coast to coast, without regard to terrain, population density, or income levels. The Commission can pave the way for a new generation of advanced mobile services for sophisticated users – services that are not available today at any price – without taking spectrum away from any other service. And by choosing to pursue these goals, the Commission will advance toward greater spectrum flexibility – thus furthering another important policy goal. It is a public policy trifecta.

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[1] In re Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band, *Notice of Proposed Rulemaking*, IB Docket No. 01-185, ET Docket No. 95-18, rel. Aug. 17, 2001, 2001 FCC LEXIS 4459 ("NPRM").

The vehicle for achieving these policies is a mobile-satellite service ("MSS") industry newly revitalized by the "ancillary terrestrial component" or "ATC" proposal set forth in the Commission's NPRM. Under this proposal, MSS networks would be permitted to incorporate ATCs into their networks in order to enhance signal availability and spectrum efficiency in urban areas. New ICO Global Communications (Holdings) Ltd. ("New ICO")[2] contends that MSS is critical for the United States and that the use of ATCs is critical for MSS.

A healthy MSS industry is of course critical because of the many important services that MSS can deliver, ranging from public safety and military applications, to commercial maritime and transport applications, to rural and recreational applications. In addition, however, the ATC proposal will make MSS networks truly ubiquitous – available in the cities where MSS currently limps, as well as in the rural areas where terrestrial coverage has always been poor. This ubiquity will foster brand new applications that depend on seamless connectivity – applications that are simply not possible with either a rural-only satellite network or an urban-only terrestrial network.

In the seven months since New ICO proposed ATC authority for MSS networks,[3] the case for the ATC proposal has only become more compelling. In July, the Commission granted MSS licenses to a new group of MSS operators in the 2 GHz band, some of whom had been pursuing MSS systems for almost ten years. In August, the Commission released its NPRM, reaffirming its commitment to rural communities, advanced services, and flexible spectrum management policies. Since September, an already weak capital market has weakened further,

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2 New ICO, a Delaware corporation, is the parent of ICO Services Limited, a UK company that has filed a letter of intent to provide 2 GHz mobile-satellite services in the United States.

3 See generally *Ex Parte* Letter from Lawrence H. Williams and Suzanne Hutchings to Chairman Michael K. Powell, dated March 8, 2001 (filed in IB Docket No. 99-81) (hereafter "New ICO March 8 *Ex Parte*") incorporated into the record of this proceeding by NPRM ¶ 5 & n.6.

making it even more important for the Commission to grant MSS providers the flexibility to make their MSS systems fully ubiquitous and economically viable.

Numerous parties have commented on the ATC proposal. Not one commenter, however, has claimed that the proposal would be bad for the MSS industry. Nor did any commenter assert that the ATC proposal would cause harmful interference to the authorized users of adjacent bands. The only negative comments have come from entrenched terrestrial incumbent operators, who say they would rather have the spectrum for themselves. This is simply not an argument against the proposal. Despite robust balance sheets and eye-popping profits for many years, the terrestrial mobile oligopoly has largely failed to provide coverage of rural America. The Commission cannot allow these companies to grab spectrum from the one service that is capable of bringing advanced services to mobile users throughout the United States and the world.

Terrestrial commenters have also suggested that it would be unfair for MSS licensees to be given authority for ATCs because MSS spectrum is not assigned by auction. This is wrong for both factual and policy reasons. As a factual matter, New ICO has already invested billions of dollars to bring advanced digital services to the very people the terrestrial interests refuse to serve. Much of this money came from investors who brought the company out of bankruptcy, essentially acquiring the license on the secondary market just as many terrestrial companies do. Moreover, the infrastructure and implementation costs are staggering. From the shuttle diplomacy required to harmonize global spectrum allocations, to the enormous cost of building a global satellite system, to the expensive and high-risk launch phase, global satellite systems simply are not cheap. Unless the Commission wishes to abandon any hope of serving rural areas, it will have to recognize that MSS systems *do* pay – they pay by providing service. And they serve the people who currently find themselves on the wrong side of the Digital Divide.

The "windfall" argument is wrong as a matter of policy and precedent as well. The Commission has recently moved aggressively in the direction of greater spectrum flexibility, allowing more and more Commission licensees to use their own spectrum in innovative ways that were not originally conceived or permitted. If conferring additional operating flexibility on an existing licensee is an unfair "windfall," then spectrum flexibility is a dead letter, because the only licensees who need flexibility are by definition those who do not now have it.

Under the NPRM's so-called "alternative proposal," terrestrial incumbents would gain exclusive access to MSS spectrum in all the more profitable, densely populated areas, without any necessary connection to MSS networks. This would relegate MSS networks to serving *only* the less profitable rural areas, despite having the system capability to serve the whole country as cost-effectively as it can serve any part of it.

An MSS system is built to serve the whole globe. Any proposal that in essence removes all of the large population centers from the addressable market is unworkable. The alternative proposal's terrestrial proponents know that it would be impossible for any MSS provider to cover all the rural areas without covering the urban areas in the same beam. They must also be cognizant of the fact that the interference from such terrestrial operations into the MSS network would make it impossible for the MSS network to serve *anyone*. They know, in short, that this "alternative proposal" is simply a stalking horse for urban PCS providers who want more spectrum – spectrum either for a seventh PCS network for large cities, or for the yet-to-be-defined applications known as "3G." The "alternative proposal" would take spectrum from an industry that can bring innovative advanced digital services to the whole country simply to provide redundant capacity to the cities. This result would deny Americans the benefits of ubiquitous MSS, and would not serve the public interest.

In these comments, New ICO addresses the questions raised in the Commission's NPRM, regarding both the primary ATC proposal and the "alternative proposal." New ICO demonstrates why the Commission's primary proposal (to permit fully integrated ATCs) is the most direct and most efficient way to promote the Commission's policy goals relating to rural deployment, advanced services, and spectrum flexibility. New ICO also demonstrates why the alternative proposal in the NPRM (to create new stand-alone terrestrial licenses using MSS spectrum throughout the MSS license area) would be impractical, inefficient, and ineffective in advancing the Commission's policy goals. But even more importantly, the alternative proposal would eviscerate the MSS licenses granted as recently as three months ago and sound the death knell for MSS.

I. A ROBUST MOBILE SATELLITE SERVICE IS AN ESSENTIAL ELEMENT OF THE WORLD'S TELECOMMUNICATIONS INFRASTRUCTURE.

New ICO applauds the Commission's reaffirmation in the *NPRM* that it is "committed to policies promoting the provision of broadband communications services to rural, unserved and underserved areas of the country."[4] The Commission's primary ATC proposal is one of the easiest and most effective ways for the Commission to promote these policies.

The Commission has long championed the MSS industry as virtually the only way to provide ubiquitous, low-cost, high-quality voice and data telecommunications services on a truly global basis.[5] Consequently, the FCC has viewed satellites as "an excellent technology for

[4] NPRM ¶ 23.

[5] *See* In re Establishment of Policies & Service Rules for the Mobile Satellite Service in the 2 GHz Band, *Report & Order*, 15 F.C.C. Rcd. 16127, 16144-46 ¶¶ 32-34 (2000) ("*2 GHz MSS Rules Order*"); *id*., *Notice of Proposed Rulemaking*, 14 F.C.C. Rcd. 4843, 4846 ¶ 4 (1999); In re Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile Satellite Service, *First Report and Order and Further Notice of Proposed Rulemaking*, 12 F.C.C. Rcd. 7388, 7389 ¶ 2 (1997), *on recon*., *Memorandum Opinion and Order and Third Notice of Proposed Rule Making and Order*, 13 F.C.C. Rcd. 23949 (1998) (affirming 2 GHz MSS allocation and seeking further comment on relocation issues); In re Amendment

delivering basic and advanced telecommunication services to unserved, rural, insular or economically isolated areas, including Native American communities, Alaska, Hawaii, and Puerto Rico, and U.S. territories and possessions such as communities within the U.S. Virginia Islands, Guam and American Samoa."[6] Nelson Mandela recently emphasized the global importance of satellite service, pointing out that "[f]or developing nations, [satellite service] may be the only answer to the challenge of connecting communities that are isolated by terrain or distance from urban telecommunications infrastructure."[7]

In the U.S., MSS systems have the unique ability to help accomplish a host of public policy goals. Millions of Americans who live in rural areas currently have no mobile voice or data service at all, and millions more have only an analog mobile voice service. For these Americans, digital voice service will be provided by MSS networks, or not at all. As the FCC has noted, "satellites may offer cost advantages over wireline access in rural and remote areas, where sparsely populated areas cannot provide the economies of scale to justify the deployment costs of wireline networks."[8] Satellites can reach "geographically isolated areas, such as mountainous regions and deep valleys, where rugged and impassable terrain may make service via terrestrial wireless or wireline telephony economically impractical."[9] And satellites can

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of the Commission's Rules to Establish New Personal Communications Services, *Memorandum Opinion and Order*, 9 F.C.C. Rcd. 4957, 4995-96 ¶¶ 94-97 (1994).

6 *2 GHz MSS Rules Order*, 15 F.C.C. Rcd. at 16145 ¶ 32.

7 Letter from N. Mandela to C. Powell, Secretary, Department of State at 2 (June 9, 2001) (attached to *Ex Parte* letter from S. Hutchings, Senior Regulatory Counsel, New ICO, to M.R. Salas, Secretary, FCC, *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service*, ET Docket No. 95-18 *et al*. (June 26, 2001)).

8 *Extending Wireless Telecommunications Services to Tribal Lands*, Report and Order and Further Notice of Proposed Rule Making, 15 F.C.C. Rcd. 11794, 11799 ¶ 13 (2000) ("*Tribal Lands Report*").

9 *Id*.

provide effective service to Native American tribal communities, which otherwise have severely limited access to telecommunications.[10]

Moreover, the MSS industry is not just about voice service. A wide range of data services that urban PCS users take for granted, such as voicemail and SMS, are simply unavailable when these users roam onto analog or even some digital networks. A ubiquitous digital MSS network can solve this problem. In addition, precisely because of its potential for ubiquitous availability, the MSS platform can support a whole new range of data applications that are simply not possible with terrestrial facilities. Nationwide telematics services will bring added safety and security to those traveling the country by land. Nationwide position tracking will give commercial transport companies better information and lower equipment costs. Exciting new aeronautical applications will boost productivity for business travelers and may well revolutionize air travel.

Likewise, public safety, military, maritime, and recreational users will benefit from MSS coverage of rural areas, even if they do not live in rural areas. Military and public safety users often depend on mobile-satellite service during natural disasters and other crises. Recreational users can gain an important additional measure of personal safety by subscribing to a robust MSS service. Maritime users, both commercial and recreational, are also a natural market for MSS. By strengthening the MSS sector's ability to serve these core markets, ATCs will benefit not only rural Americans, but all Americans. And all Americans will also benefit from the strong satellite manufacturing capability that a revitalized MSS industry would help to sustain.

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10 On 48% of the 48 largest tribal reservations, telephone penetration rates are below 60%; on a third of those reservations, penetration rates are below 50%. *Tribal Lands Report,* 15 F.C.C. Rcd. at 11798 ¶ 8. One third of ZIP codes in Native American tribal lands have no high-speed subscribers. In re Inquiry Concerning the Deployment of Advanced Telecommunications Capability, *Third Notice of Inquiry*, FCC No. 01-223 ¶ 15 (Aug. 10, 2001) (reporting that 63 percent of the most sparsely populated zip codes do not have a single high-speed subscriber, as of December 2000).

Services such as ICO's will offer millions of average Americans in rural areas more data bandwidth than they can get at a comparable price from their wireline phone company. The development of advanced wireline infrastructure (cable modem and DSL equipment) in rural areas is even more limited than the development of digital wireless infrastructure. Whereas 99.9% of consumers in the most densely populated ZIP codes currently have access to high-speed data service, only 58.6% of consumers in the least-populated ZIP codes appear to have a high-speed option.[11] The Commission has correctly noted, therefore, that satellite service "may provide consumers and small businesses in geographically remote and sparsely populated areas with access to high-speed services that would not otherwise be available."[12]

With data rates ranging up to 384 kbps possible via the ICO system, many Americans may find an MSS network to be their best choice for fast data communications. The Commission has already concluded that market forces alone will not guarantee that rural Americans have access to advanced telecommunications services.[13] Of course, advanced service deployment concerns are even more acute in those parts of the world where the wireline and wireless infrastructure is less developed, or non-existent.

The importance of a vibrant MSS sector is obvious in light of the evident inability of terrestrial technologies to provide ubiquitous coverage. Terrestrial digital wireless networks, for

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11 *High-Speed Services for Internet Access: Subscribership as of Dec. 31, 2000,* Industry Analysis Division, Common Carrier Bureau, FCC (rel. Aug. 2001) (available online at www.fcc.gov/bureaus/commoncarrier/reports.fcc-statelink/comp.html).

12 In re Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, *Second Report*, 15 F.CC. Rcd. 20913, 20937 (2000) ("*Advanced Services Second Report*").

13 *Advanced Services Second Report*, 15 F.C.C. Rcd. at 20996 ¶¶ 220-22 ("[M]any customers in outlying areas may be too far from a central office for DSL and may live in areas that are too sparsely populated to be served by a cable operator").

example, will never cover large portions of the United States. Low population densities simply make many high-cost areas of the country uneconomical for terrestrial wireless providers. Figure 1 shows the sparse geographic coverage of the United States by terrestrial digital networks.[14]

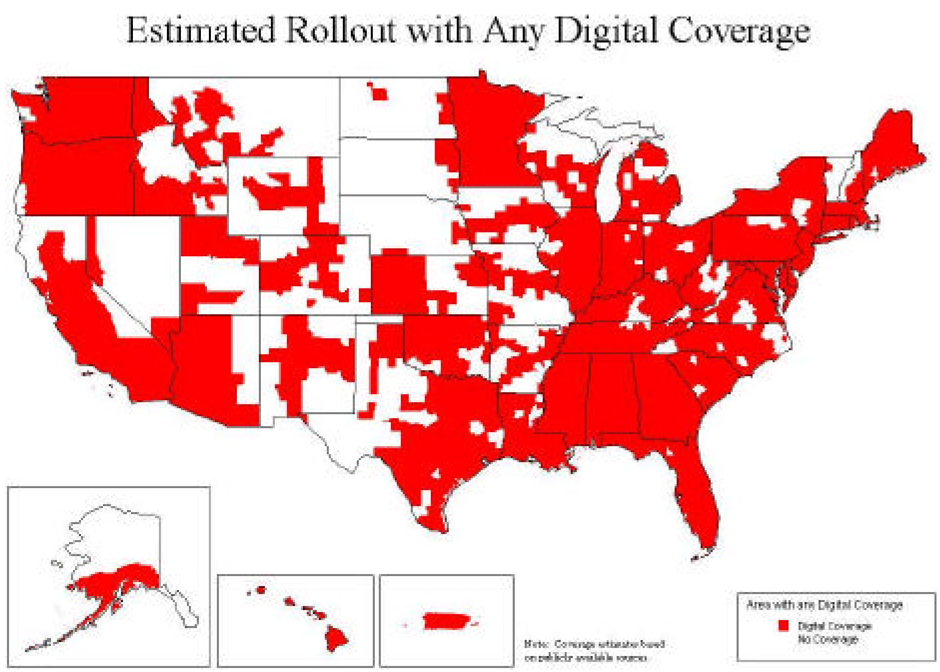

Figure 1
Source: Sixth CMRS Report

As one can readily see from Figure 1, there are many parts of the country without digital coverage. Indeed, there are entire states with practically no digital coverage at all. And the coverage pattern in Figure 1 *exaggerates* the extent of *actual* coverage because it is based on county-by-county data that gloss over the frustrating "dead spots" that occur particularly often in rural America.

As bad as the "any digital" coverage map in Figure 1 looks, Figures 2 and 3 are even more dismal. Figure 2 shows the portion of the nation that is estimated to be covered by CDMA.

[14] In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, *Sixth Report* (FCC 01-192), 16 F.C.C. Rcd. 13350 (2001), at E-3.

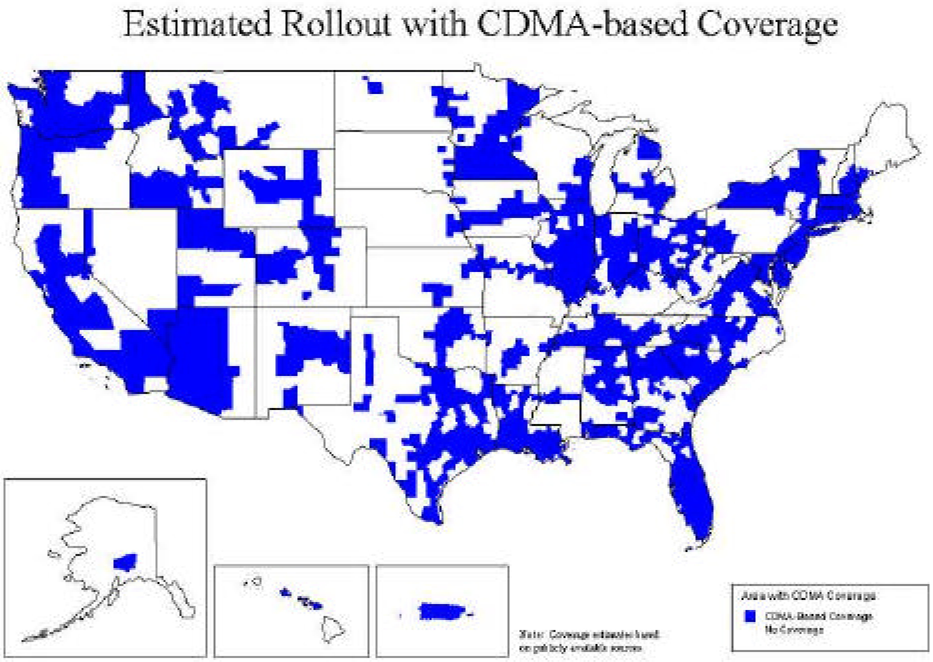

Figure 2
Source: Sixth CMRS Report

Likewise, Figure 3 (based on commercial rather than FCC data) shows the tiny portion of the country in which GSM service is available.

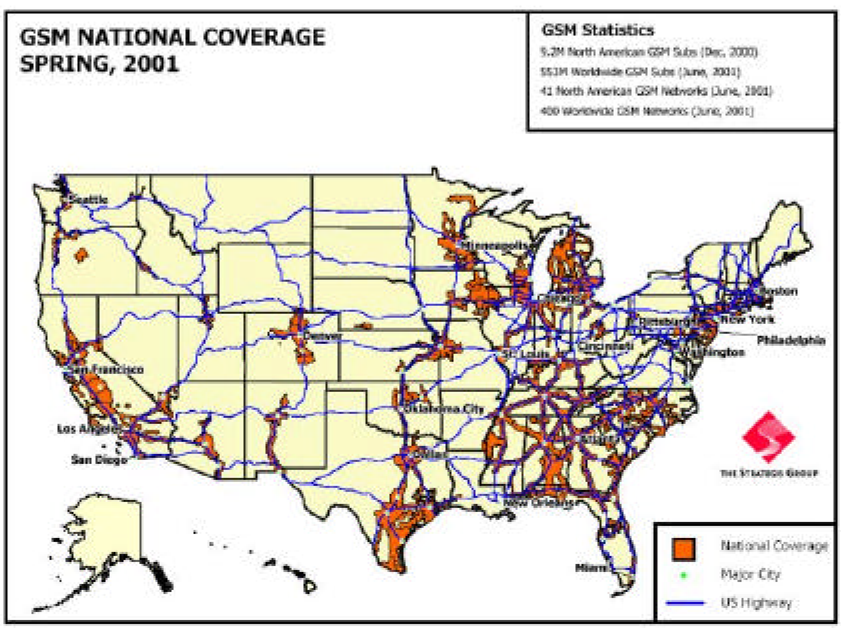

Figure 3
Source: Wireless Week, Industry Research, PCS Buildout Maps.
http://www.wirelessweek.com/contents/images/GSM_natl.pdf

As one can readily see from Figures 2 and 3 the portion of North America in which one can receive digital services while remaining "on-net" is incredibly small. An analysis of the coverage maps of all the leading digital PCS networks leads to the same conclusion. Existing terrestrial wireless deployment simply leaves out rural users and those sophisticated users who need to be "on-net" in order to have access to advanced applications.[15] Even analog coverage remains far from ubiquitous.[16]

It is important for all to acknowledge that poor urban coverage is not a consequence of any shortage of spectrum. Although incumbent mobile operators would undoubtedly like to take some of the 2 GHz MSS spectrum away from MSS, that will do nothing to boost rural deployment. On the contrary, in the March 1999 PCS re-auction (Auction No. 22), there were 45 licenses that went unsold – licenses that "primarily cover small populations in rural areas."[17] The terrestrial mobile industry has had ample opportunity to serve these areas, and it has declined. MSS will accept the challenge and succeed.

The difficulty of serving rural America extends to wireline networks as well. Present narrowband wired access cost is driven by two components: central office expense (i.e., building and operating the exchange) and the outside plant costs (i.e., transmission facilities such as copper and fiber). A typical rural telecom exchange (six homes per square mile) costs, much

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15 *See* parts II.A and II.C, *infra*.

16 Analog coverage maps look more promising for rural America, but there is less there than meets the eye. The situation has been characterized as one in which "analog slum lords" charge "high prices for not-so-great service." Nobel, "Rural Locations Out of Wireless Loop," eWeek, Jan. 22, 2001 (available at http://www.eweek.com/article/0,3658,s%253D701%2526a%253D11475,00.asp).

17 Petition for Expedited Rulemaking or, in the Alternative, Waiver of the Commission's Rules, *appended to* FCC Public Notice, *Wireless Telecommunications Bureau Seeks Comment On Nextel Communication, Inc.'s Petition Regarding PCS C And F Block Spectrum; Extension of Filing Deadline for Comments to SBC Communications Inc.'s Request for Waiver*, 15 F.C.C. Rcd. 2104 (2000).

more per customer to operate and maintain than a typical downtown exchange (256 homes per square mile), as Figures 4 and 5 illustrate:

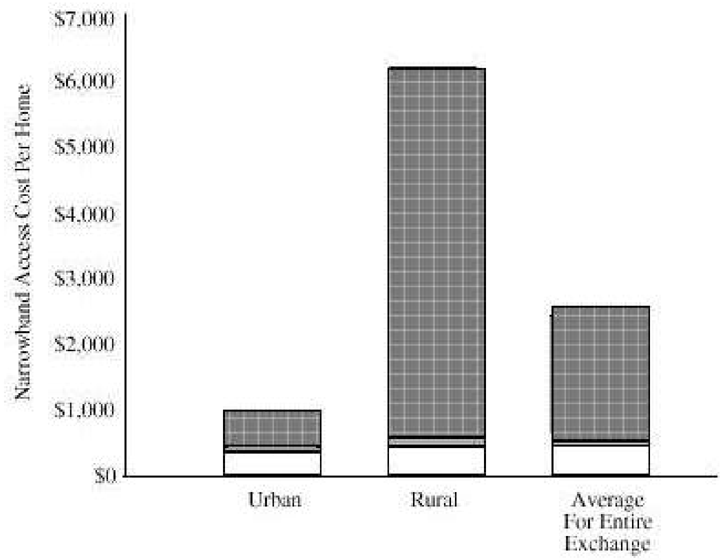

Figure 4 – Central Office Expense per Home
Source: Rural Task Force

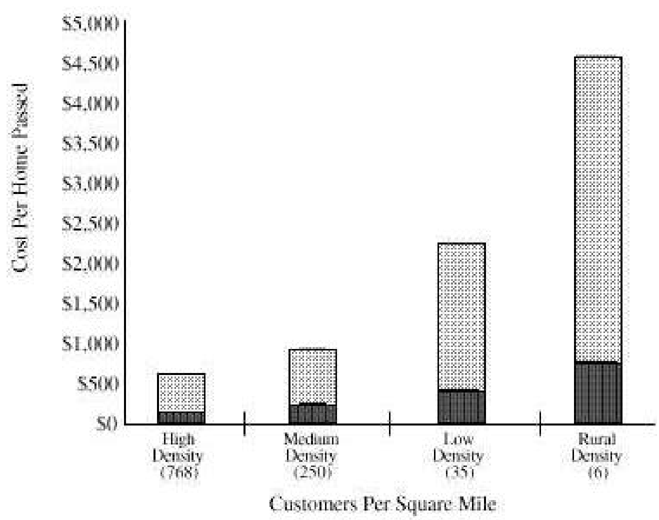

Figure 5 – Outside plant Costs per Home
Source: Rural Task Force

The economics of terrestrial deployment essentially deprives citizens in rural and high-cost areas of the benefits associated with advanced services that consumers in urban areas generally take for granted. In addition, it prevents the deployment of digital wireless infrastructure for public safety applications in substantial portions of the United States and the world.

Universal service for customers in rural and high-cost areas has been a cornerstone of U.S. telecom policy for nearly seventy years. Federal and State regulators have pursued this policy through a system of implicit or explicit subsidies. MSS networks, in which the cost of carrying a given transmission is completely insensitive to the user's location, provide a market-based mechanism to provide advanced services to rural areas, without any type of "universal service" subsidy. The same satellite that covers New York City will also cover the Adirondacks; the same network that carries calls from Washington, D.C. will also carry calls from West Virginia and South Dakota. With MSS, service to rural and high-cost areas requires no subsidy because MSS service to rural and high-cost areas does not cost any more than MSS service to urban areas.

Even in those areas covered by terrestrial wireline and wireless systems, MSS continues to offer a vital means of communications, particularly in times of emergency and disaster. Ground-based terrestrial wireless communications systems are susceptible to numerous forces—such as loss of power and/or physical damage resulting from environmental or man-made cataclysms—that do not endanger MSS systems. Time and again, MSS has proven to be the only effective means of communications at times and in locations where terrestrial wireline and wireless systems have failed. Most recently, MSS telephones were deployed by rescue workers at the sites of both the World Trade Center and Pentagon attacks when transmission towers that powered cellular phones were destroyed or remaining capacity was over-taxed.[18] MSS

[18] *See Rescue Workers Get New Phones*, St. Petersburg Times, Sept. 18, 2001, at 9A (reporting that rescuers and city crews were having difficulty with the recovery effort because cell phones often did not work in lower Manhattan, prompting President Bush to provide 200 special satellite phones for rescue workers at the World Trade Center); Sarah Bisker, *Ohio University Satellite Relieves Telephone Line Congestion*, University Wire,

telephones also were instrumental in other rescue and relief efforts involving earthquakes,[19] hurricanes,[20] tornadoes,[21] cyclones,[22] floods,[23] forest fires,[24] and refugee migrations.[25] In addition,

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Sept. 12, 2001 (reporting that the New York State Emergency Management Agency requested use of a NASA satellite to provide alternative communications routes); Jane Larson, *Iridium's Phones Suddenly In Demand; With Land Service Out, System Aids In Crisis*, The Arizona Republic, Sept. 13, 2001; Dick Kelsey, *Satellite Phone Interest Renewed After Attack Rescue Use*, Newsbytes, Sept. 25, 2001; *Satellite Phones Show Value As Supplemental Service*, Satellite Today, Sept. 14, 2001.

19 *See, e.g.*, Veronique Mistiaen, *Calls for Help: How A Communications Charity Is Offering Life Lines In Disaster Relief*, The Guardian (London), Aug. 30, 2000, at 7 (noting that the French charity organization, Telecoms Sans Frontieres, was able to help save 14 lives in the 1999 earthquake in Istanbul, Turkey, by using satellite phones to locate much needed relief equipment and that it had previously used satellite phones to aid Kosovar refugees in Albania with calling their families); *COMSAT Providing Earthquake Assistance In Turkey*, PR Newswire, August 25, 1999; Central News Agency, Taipei, *Nantou County Worst Hit By Earthquake*, The British Broadcasting Corporation, Sept. 24, 1999 (noting that satellite phones were supplied to rescue workers during the September 21, 1999, earthquake in Nantou County, Taiwan); American Embassy, Tokyo, *Japan Emergency Preparedness Products/Service Market*, Industry Sector Analysis, July 15, 1997 (explaining Japan's substantial investment in satellite phone technology for disaster prevention); George Nirmala, *Death Toll in Indian Earthquake at 13,000*, Chattanooga Times/Chattanooga Free Press, Jan. 28, 2001, at A1; Duncan Campbell, *El Salvador Earthquake: Contested Property Scheme Blamed for Many Deaths*, The Guardian (London), Jan. 6, 2001.

20 *See, e.g.*, Amy E. Hancock, *Satellite Phones, Capacity and Little LEOs: The Disaster Relief Equation*, Satellite Communications, July 2000 (quoting an American Red Cross official as saying with respect to Hurricane Marilyn, "We went down there and practically every phone line was down. Our only reliable means of communication for the first seven to 10 days was Inmarsat satellite technology."); Global Telephony Staff, *To The Rescue*, Global Telephony, Feb. 1999 (noting that Iridium satellite phones and free satellite service were distributed to disaster relief teams helping victims of Hurricane Mitch in Central America); Clayton Mowry, *Satellites Save Lives*, Satellite Communications, Feb. 1999; *COMSAT Satellite Phones Provide Voice and Data Communications To Aid Hurricane Mitch Relief Effort; Planet 1™ Phones and Service Donated for Disaster Relief Operations In Honduras and Nicaragua*, PR Newswire, Dec. 7, 1998; Tom Shean, *Insurers Swing Into Action*, The Virginian-Pilot (Norfolk, VA), Aug. 26, 1998 (reporting that State Farm insurance company provided its adjusters with satellite phones to facilitate claims processing where telephone lines and antenna towers were toppled).

21 *See, e.g.*, Jane Reynolds, *Aid Pours In After Tornado In Rockingham*, News & Record (Greensboro, NC), Mar. 22, 1998.

22 *See, e.g.*, Paramvir Singh, *Telecommunications: Iridium Phones Provide Vital Link During Cyclone* Financial Express, Nov. 16, 1999 (reporting the widespread use of Iridium satellite phones by relief workers used by various agencies working with victims of the super cyclone which hit Orissa, India in September 1999); *Cyclone Belt Turns To Satellite*, The Dominion (Wellington), Apr. 14, 1998 (reporting that the telecommunications carriers of Fiji, Tonga, Samoa, Niue and the Solomon Islands were turning to satellite phones to provide communications during outages caused by cyclones).

23 *See, e.g.*, Mitchell Maddux & Justo Bautista, *Cold War Radio Links Priceless In Emergency Ham Operators Stepped In When Phone Systems Went Down*, The Record (Bergen County, N.J.), Sept. 17, 2000 (noting that floods caused by Tropical Storm Floyd in Bergen and Passaic counties left local emergency services without communications service, and that this led them to purchase satellite phones); *Inmarsat Comes to the Rescue of Homeless Flood Victims in North-East Italy; Satphones Deployed By Telecoms Sans Frontiers Form the Only Communications Link In Storm-Ravaged Regions*, M2 Presswire, Oct. 18, 2000.

MSS telephones are a staple of federal disaster teams focusing on national security[26] and private disaster agencies such as the Red Cross.[27]

In short, it is in the public interest to promote the strongest possible MSS industry. The need for this essential element of our communications infrastructure is the single most important reason why the Commission should adopt its primary ATC proposal.

II. ALLOWING MSS PROVIDERS TO INTEGRATE ATCs INTO THEIR NETWORKS WILL ENSURE THE VITALITY OF MSS NETWORKS.

The Commission's NPRM captures well the urgent need to give 2 GHz MSS operators the spectrum flexibility they need in order to incorporate ATCs into their networks.[28] In a nutshell, traditional MSS architectures have a difficult time providing in-building and urban coverage (the "urban signal problem"), because of signal attenuation from walls, roofs, and even

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24 *See, e.g.*, Shane Schick, *Globalstar Answers the Call for Nunavik's Communications*, Technology in Government, Dec. 2000, at 15; *INFOSAT Telecommunications -- Europeans No Longer 'Lost in Space'*, Canada NewsWire Ltd., Sept. 16, 1999 (noting the use of satellite phones by British Columbia's Forest Service for fighting forest fires.).

25 *See, e.g.*, Bill Roberts, *Telecom Without Borders: A Satellite Lifeline for Refugees*, Via Satellite, Feb. 1, 2000; *US Digital to Provide Iridium Satellite Phones to Kosovo Media And Disaster Relief Efforts; Dispatch Mobile Communications Services to Be Offered*, PR Newswire, Apr. 7, 1999.

26 *See, e.g.*, Ed Timms, *Cleaning Hazardous Materials Gives Troops Practical Experience*, The Dallas Morning News, Oct. 10, 2000 (noting that the 6th Weapons of Mass Destruction (WMD) Civil Support Team of the National Guard, based in Austin, Texas, and one of several such National Guard units set up by the U.S. government to assist civilian authorities in the vent of a terrorist attack, utilizes satellite phone to maintain communications because "[i]n a disaster…phone lines and cell networks frequently can't handle the traffic."); *Troops Gaining Practical Experience Cleaning Hazardous Materials Along Texas Coast*, The Associated Press State & Local Wire, Oct. 5, 2000.

27 *See* Thai Thanh, *Red Cross Association Gets Ericsson Satellite Phones*, The Saigon Times Daily, March 30, 2001 (discussing presentation of satellite phones to the Vietnam Red Cross Association by Ericsson Vietnam to facilitate communications during emergency activities); Mohammed Harbi, *Humanitarian Solution to Hardware Restraints*, Communications Week International, June 29, 1998 (reporting how disaster relief agencies like the International Federation of Red Cross and Red Crescent Societies, the United Nations and Swiss Disaster Relief all rely heavily on satellite phone systems to respond to disasters); *American Red Cross and Globalstar USA Put Satellite Phones to Use for Disaster Relief*, Business Wire, July 27, 2000.

28 NPRM ¶ 24.

"urban canyons" that obstruct the line of sight to otherwise visible satellites. This urban signal problem reduces demand for MSS not only in urban areas but in rural areas as well (the "market size problem"), because phones that do not work reliably in large cities are simply less useful, even to people who spend most of their time in rural and small town America. Finally, the urban signal problem and the market size problem combine to discourage adequate investment in end user equipment (the "product investment problem"), leading to large, expensive phones that make MSS even less attractive to potential urban and rural users. This vicious cycle has bedeviled first-generation MSS projects to date, and will continue to prevent MSS from achieving its mission unless the cycle can be reversed.

The lackluster performance of first-generation MSS networks has left two main types of potential users out in the cold. First, and most obviously, there are millions of rural and remote users with no other choice for mobile data or voice telephony. If MSS prices itself out of this market, these users must go without any mobile service at all. The second and more subtle unserved market consists of sophisticated users who need to be "on-net" at all times, no matter where they are. These users rely on advanced features and applications that are not typically available while roaming from one terrestrial network to another. If the MSS industry cannot serve these sophisticated users, there is simply no other technology able to fill the gap.

Fortunately, the Commission's primary ATC proposal will ensure the vitality of MSS networks by addressing directly the urban signal problem, the market size problem, and the product investment problem. In addition, the use of fully integrated ATCs will solve these problems in the most spectrum-efficient way, avoiding the expense, complexity, and inefficiencies that characterize dual-band roaming arrangements. These potential benefits of the Commission's primary proposal are discussed in turn below.

A. Integrated ATCs Will Remedy the Signal Problems That Have Plagued First-Generation MSS Networks.

In a March 8, 2001 *Ex Parte* letter,[29] New ICO described in general terms the nature of the urban signal problem faced by MSS operators.[30] In summary, an MSS handset generally cannot connect to a satellite when the subscriber is located inside a typical office building. To address this problem, ICO is exploring the use of personal "repeater" accessories[31] based on Bluetooth or IEEE 802.11 technologies, and these approaches show great promise for residential areas and perhaps even in isolated office buildings where "urban canyons" do not create severe blockage problems (in many small towns, for example). However, in the most densely populated areas, in which lower-floor windows and even some rooftops often lack a clear line of sight to most of the sky, personal repeaters will not ensure adequate service.[32]

New ICO has collected extensive propagation data to substantiate these general observations. Between 1992 and 1999, ICO conducted no fewer than seven different propagation measurement campaigns using aircraft, helicopters, geostationary satellites, towers, and a dirigible. The resulting data include signal measurements from more than 1200 different scenarios. These data reveal that a large (multi-story) office building in a typical urban area will attenuate the signal received by an indoor MSS user by 30-40 dB, well in excess of a typical MSS link margin. (New ICO's link margin will typically be 8-12 dB.) Even in small residential

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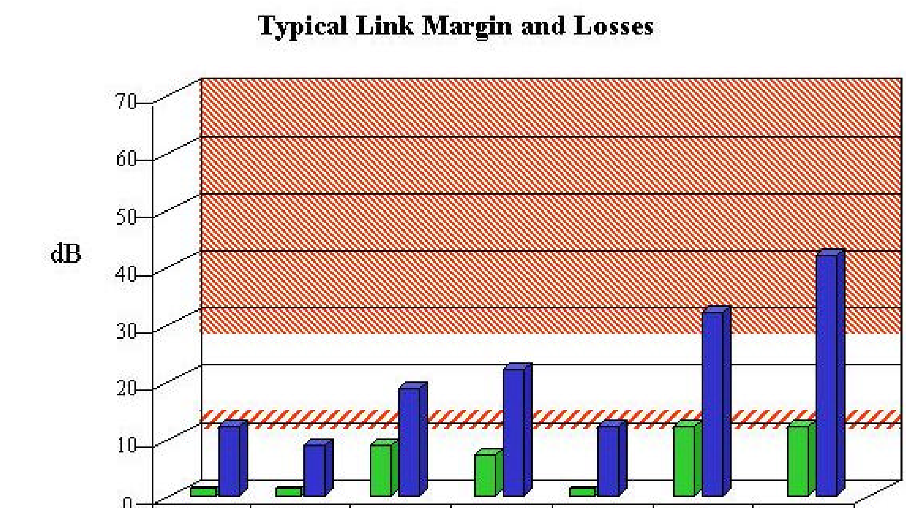
29 New ICO March 8 *Ex Parte*, *supra* note 2.

30 *Id.* at 3-5.

31 *See id.* at 5.

32 This provides the answer to two of the questions raised by the Commission in paragraph 26 of the NPRM: "If MSS terrestrial operations were confined to large urban areas, to what extent would indoor service problems in other areas limit the market for MSS service there? And if terrestrial operations were widespread, would the resulting communications offered by MSS operators become primarily terrestrial based rather than satellite based?" Not every building, nor every city, requires an ATC solution. Under the Commission's primary ATC proposal, ATCs can only be used by MSS operators who have satellites in orbit and operating. If those satellites are adequate to provide coverage, there is little risk that the MSS operator will invest in ATC facilities in areas where they are unnecessary.

and rural buildings, attenuation can be as much as 25 dB. Figure 6 illustrates typical link margin and losses in a variety of environments.



	multipath fading	head blockage	torso blockage	medium foliage	in-building unblocked	Urban Canyon	in-building deep inside
minimum	0	0	6	5	0	10	10
maximum	10	6	16	20	10	30	40
ICO MSS Link Margin: 8-12 dB							
Typical PCS or ATC Link Margin: 25-70 dB							

Figure 6

Many factors affect the degree of attenuation, of course, including the user's position within the building, the type of window coatings, the roof materials, and the extent of foliage near the building that may inhibit line of sight to the satellite. It is clear, however, that in the most densely populated areas, where unlicensed repeaters and fixed antennas are not a viable solution, MSS service will be impossible without the use of ATC base stations. In these areas, the Commission's primary proposal for an integrated ATC – with power budgets similar to those governing 1900 MHz PCS – will provide the coverage that is non-existent in first-generation MSS networks.

B. Integrated ATCs Will Allow MSS Subscribers to Benefit from Economies of Scale.

By solving the urban signal problem, integrated ATCs will in turn solve the market size and product investment problems. The ATC proposal will achieve this result both by making MSS more attractive to "traditional" MSS market segments, and by creating brand new markets based on seamless service offerings – offerings that simply cannot be provided either by an MSS network that fails to provide reliable service in dense urban areas or by a terrestrial operator that can only offer limited geographic coverage.

The underlying benefits of an integrated ATC approach for "traditional" MSS market segments – such as rural[33] and small-town users[34] – are self-evident. Millions of potential subscribers in these markets spend significant amounts of time outside the range of terrestrial mobile networks, making them natural MSS customers. Many of these potential subscribers, however, also spend significant amounts of time in urban environments where satellite-only MSS may be unavailable. The addition of integrated ATCs will allow these customers to remain "on-net" at all times, with consistent service quality, a single point of contact, and a single pricing plan. The failure of first-generation MSS networks to provide the sort of seamless convenience and safety that urban PCS subscribers take for granted – a failure that ATCs can remedy – has made first-generation MSS unattractive to these numerous potential subscribers. And for the most part, these are consumers who are currently not on a mobile network because

[33] New ICO considers potential subscribers to be "rural" if they are located or traveling in areas where terrestrial wireless services are non-existent and even the wireline network is inadequate to support advanced services. New ICO estimates that this description applies to 30% of the U.S. land mass and 5% of the U.S. population (or 15 million Americans). Business customers in this market segment would include remote agriculture, utilities, mining, NGOs, news organizations, oil and gas companies, and heavy construction companies.

[34] New ICO defines the "small town" market segment to consist of businesses and individuals in communities covered by voice-only analog networks. These customers may spend 25% of their time completely outside of even analog AMPS coverage, and also roam into larger cities where more advanced wireless services are available, but not to roamers.

neither terrestrial wireless service nor first-generation MSS networks can adequately meet their needs.

The maritime market segment illustrates the public interest benefits derived specifically from ATC-driven economies of scale. Maritime service is, of course, a traditional MSS market, meeting not only commercial or social needs, but also important safety requirements. Many ships are required to carry equipment for distress and safety communications, and MSS is the best available option. However, many smaller ships try to do without existing MSS equipment because of its cost and size. Fewer than 50,000 ships worldwide are equipped with voice-capable satellite equipment; the low production volume keeps the equipment and the service expensive.

Today, all too many small- and medium-sized craft rely on inferior terrestrial systems – including not just HF and VHF radios, but even ordinary cell phones – for critical distress and safety communications. From a public safety perspective, this is troubling, because the smaller ships are the most vulnerable to danger at sea.[35]

The Commission's primary proposal for integrated ATCs will address this problem not by improving signal coverage of coastal and international waters, but by allowing these users to benefit from scale economies. Even though maritime equipment will be larger and more sophisticated than mass-production handsets, the OEM board (the most expensive component) will be the same for all of the various New ICO user terminals, reducing the cost and size for all users. Economies of scale will help New ICO provide better and more economical access to data

[35] According to the U.S. Coast Guard Recreational Boating Accidents Statistics, recreational boaters were involved in a total of 7,931 accidents in 1999, which caused 734 fatalities and injured 4,315 people, just in the United States. U.S. Coast Guard, Boating Statistics – 1999, at 4 (available online from www.uscgboating.org).

services (SMS, e-mail, web browsing, electronic chart updates, weather information, and navigational warnings), as well as ordinary voice communications, to thousands of additional vessels and their passengers. These are benefits which no terrestrial service can offer, but which can be provided to maritime users only if MSS operators are permitted to incorporate integrated ATCs into their networks.

C. Integrated ATCs Will Foster the Development of New Technologies Based on Seamless Service Offerings

Allowing MSS networks to incorporate ATCs in the most densely populated urban areas will enable MSS operators to make brand new digital applications generally available for the very first time. For example, telematics services will provide motorists with location information not only on the "open road" but also in parking garages and "urban canyons" where journeys often begin and end. For the first time, integrated ATCs will make it possible for MSS networks to offer true nationwide commercial transportation tracking services on a single platform, eliminating the need for commercial vehicles to carry multiple transceivers for multiple networks.[36] Likewise, public safety officials need never again lose contact with their dispatchers when their duties take them from urban to rural areas or *vice versa*, because public safety agencies in these areas will finally have the ability to select a single network that can carry all their voice traffic while handling the data requirements generated by officers in the field. Finally, as the history of telecommunications has shown time and again, customers and service providers will invent new uses for this type of connectivity once it becomes available.

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36 Less than 5% of the 7 million large and medium-sized commercial trucks in the U.S. are currently equipped with a satellite-based fleet management communications system. Trucks that are so equipped must often combine satellite-based systems with incompatible terrestrial-based equipment for urban areas.

Some first-generation MSS networks have tried to address the "urban signal problem" with dual-band roaming approaches, selling satellite phones that are capable of roaming onto terrestrial networks when they are within terrestrial coverage.[37] These roaming arrangements, however, do not address the inherent inefficiency of having separate pools of "urban-only" spectrum that is never used in rural areas. While 2 GHz MSS networks might ultimately negotiate such roaming agreements with existing terrestrial carriers (e.g., as a feature for their "urban only" subscribers), it is important to understand the limitations of these arrangements and to appreciate how they differ from an integrated MSS network that incorporates ATCs.

Roaming from one network to another works fairly well for basic voice services: Most carriers have sufficient roaming agreements in place so that one can usually complete a call outside one's home coverage area, even if the pricing and the availability of customer care is less than optimal. However, more advanced network features like "push to talk" are typically only available on one's home network, and even rudimentary data services are often unavailable while roaming. Text messaging may also be unavailable, and users may find themselves unable to retrieve voicemails while roaming.

Service availability while roaming becomes worse as the data applications become more complicated. To take one of the examples used above, a trucking company that uses a single position tracking application for its entire fleet cannot simply have its trucks roam on and off of different terrestrial networks, because the networks will all use different platforms and not all of them will support the desired tracking application. Similarly, in a police chase that crosses numerous jurisdictional lines, police officers may find themselves unable to retrieve data at a

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37 *Cf. NPRM* ¶ 27 (inquiring about "alternative arrangements" such as dual-band roaming).

critical moment. A truly seamless advanced voice and data network would be able to meet the needs of such sophisticated customers in a way that dual-band roaming cannot.

Integrated ATCs will not just improve service for existing MSS customers; they will expand the market for MSS services by creating for the very first time an integrated network architecture that is available across the entire country. Access to these new markets would fundamentally alter the economics of the user equipment market. ICO estimates that the incorporation of ATCs into the ICO network could reduce the price of a standard user transceiver by more than 80 percent, bringing the cost of the MSS user equipment into a range of comparability with terrestrial handheld phones. And significantly, these scale economies result primarily from bringing brand new services to those who are currently unserved.

D. Integrated ATCs Will Achieve Global Coverage in the Most Spectrum-Efficient Way.

More efficient use of the radio spectrum has long been one of the Commission's primary goals. That has never been more true than today. Indeed, in a world where "[t]echnological advances, consumer demand, and the finite nature of spectrum have made [the Commission's] spectrum management responsibilities increasingly complex" and "[t]here is very little unencumbered spectrum available for new services,"[38] the Commission has characterized "promoting greater efficiency in spectrum markets" as the first and most important of its spectrum policy priorities.[39]

Implementation of ATCs will improve spectrum efficiency not by altering the number of times spectrum is re-used in different beams of a particular satellite system, but rather by

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[38] In re Principles for Reallocation of Spectrum to Encourage the Development of Telecommunications Technologies for the New Millennium, *Policy Statement*, 14 F.C.C. Rcd. 19868, 19869 (1999) ("*Spectrum Policy Statement*").

[39] *See id*., 14 F.C.C. Rcd. at 19870.

enabling the already assigned MSS spectrum to become useful in urban areas. By marshalling both satellite and ATC resources within the same integrated MSS network, the MSS operator will be able to ensure that each element of the network is used in the most efficient way. It bears repeating that careful integration of the satellite and ancillary terrestrial components of an MSS network is the key to facilitating more efficient use of MSS spectrum. Satellite and ATC operations will need to be harmonized in countless ways, from network and handset design, to radio frequency design parameters and management; *e.g.*, base station cell size planning, base station antenna gain pattern design, user power and admission control, *etc.*

The spectrum wastefulness of the *status quo* stems from the fact that satellite-only MSS networks cannot use their spectrum effectively in urban settings, while terrestrial networks cannot use their spectrum economically in rural environments. To date, both Mobile and Mobile-Satellite allocations have generally been implemented so that a given band is used to serve rural areas or urban areas – but not both. The primary proposal for integrated ATCs would avoid this spectrum wastefulness by allowing a single network operator to optimize a single allocation in such a way that both rural and urban areas will be served by the most efficient and appropriate network architecture.[40]

In fact, meeting the demand generated in urban areas through integrated ATCs will actually ensure that adequate satellite capacity remains available for rural applications – despite the increased urban demand that will follow from enhanced urban coverage. As noted above, a single beam covers a very large area on the ground, and the amount of capacity available in a

[40] The techniques available to achieve these efficiencies within a single integrated network – including elements of network design, dynamic resource management protocols, admission controls, and other techniques – are discussed in more detail in part IV, *infra*.

single beam is finite. Hence, in a satellite-only network, every transmission from a subscriber in New York City uses up capacity that would otherwise be available for a subscriber in Albany or the Adirondacks, and *vice versa*. And despite the signal attenuation problems created by New York City's urban canyons, the density of the population there ensures that a significant portion of the satellite capacity will be used in the city – by roamers and others who happen to be in parts of the city where MSS coverage is unobstructed. Improving MSS signal coverage in New York City will, of course, increase the demands that urban users make on the MSS network. However, use of an ATC will at the same time facilitate the routing of most urban traffic so as to minimize the burden on the satellite portion of that network. For example, urban callers who would use up satellite capacity in a satellite-only network will instead be migrated to a terrestrial infrastructure that has the capability to efficiently re-use frequencies in a much smaller area and hence much more often. By keeping portions of the traffic from densely populated areas off of the satellites, the ATC segment will leave more satellite capacity available for rural use than if the urban users were all routed through the satellite component of the MSS network.[41]

III. ALLOWING MSS PROVIDERS TO INTEGRATE ATCs INTO THEIR NETWORKS WILL FURTHER THE COMMISSION'S POLICY OF SPECTRUM FLEXIBILITY.

As the Commission struggles with ways to accommodate ever-increasing demands for scarce spectrum, it has recognized that flexible allocations, and their resulting efficiencies, are a vital part of the solution.[42] Indeed, the Commission has increasingly been willing to give

[41] It should be noted that the public interest would *not* be served by requiring MSS operators to route all traffic through the satellite portion of the network, for just this reason. Similarly, the Commission should not require all MSS traffic to be routed through a central data switch. Such a requirement would serve no useful purpose; on the contrary, it would make urban MSS traffic more vulnerable to outage (because it would create a single point of failure) and more expensive (because it would prevent network operators from using least-cost routing).

[42] *See Spectrum Policy Statement*, 14 F.C.C. Rcd. at 19870-71; In re Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets, *Policy Statement*, 15 F.C.C. Rcd. 24178, 24180-81 (2000) ("*Secondary Markets Policy Statement*").

licensees added flexibility, both in the way they use the spectrum and in the extent to which they allow others to make use of it.

In a number of cases, the Commission has cleared away regulatory roadblocks that prevented licensees from using their networks at full capacity. For example, Direct Broadcast Satellite licensees (who use Broadcasting-Satellite Service allocations rather than Fixed-Satellite Service allocations) have long been permitted to use their capacity for Fixed-Satellite Service.[43] Similarly, the Commission has long allowed Commercial Mobile Radio Service ("CMRS") licensees to provide fixed communications offerings in addition to the mobile offerings for which they were originally licensed.[44] The Commission has also authorized digital television licensees to lease their vertical blanking intervals and visual signal telecommunications facilities to outside parties for ancillary data transmissions that would not otherwise qualify as "broadcast" transmissions.[45] And more recently – in fact, after the NPRM in this proceeding – the Commission has paved the way for MMDS licensees to provide mobile services either in addition to or instead of the fixed services they currently provide.[46]

Interestingly, the Commission often grants significant spectrum flexibility for the express purpose of enhancing the economic viability of an important but struggling existing service. That was the case when the Commission allowed Instructional Television Fixed Service

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43 In re Revision of Rules and Policies for the Direct Broadcast Satellite Service, *Report and Order*, 11 F.C.C. Rcd. 9712, 9717-9720, FCC 95-507 (1995), ¶¶ 12-22 (citing *United States Satellite Broadcasting Co.*, 1 F.C.C. Rcd. 977 (1986), and *Potential Uses of DBS,* 6 F.C.C. Rcd. 2581 (1991).

44 In re Amendment of the Commission's Rules to Establish New Narrowband Personal Communication Services, *First Report & Order,* 8 F.C.C. Rcd. 7162, 7164 (1993).

45 *See* 47 C.F.R. § 73.646(d); *see also* In re Digital Data Transmission Within the Video Portion of Television Broadcast Station Transmissions, *Report and Order*, 11 F.C.C. Rcd. 7799, 7892 ¶ 8 (1996); "Commission Approves Microsoft Ancillary Data Transmission System," *News Release*, Report No. MM 96-18 (rel. Oct. 24, 1996).

46 *See* In re Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services, *First Report & Order & Memorandum Opinion & Order*, ET Docket No. 00-258 (rel. Sept. 24, 2001).

("ITFS") licensees to lease spectrum to commercial operators, who could then offer non-ITFS services using ITFS spectrum.[47] The Commission acted specifically so that commercial operators could "provide funding used by ITFS licensees for their educational mission."[48] Indeed, the Commission's rationale for allowing non-ITFS service over ITFS spectrum was as follows:

> [T]he cost of constructing and operating an [ITFS] system represents a significant burden to licensees. In addition, the cost of education is increasing daily. . . . [N]ew revenue sources are necessary in order to give [ITFS] every chance to grow and succeed.[49]

Faced with evidence that the "pure" ITFS was not economically viable, the Commission, rather than abandoning the service entirely, amended its rules to permit lessees to offer non-ITFS service over ITFS spectrum. (Such service might even be thought of as "ancillary" to the ITFS service.)

Even more recently, the Commission took a similar step for similar reasons when it amended the service definitions for MDS and ITFS in order to give those licensees the authority to transmit two-way digital data. Both services had historically been limited to one-way radio transmissions, but when faced with evidence that the traditional service limitations were

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[47] *See* 47 C.F.R. § 74.931(a) (providing that ITFS channels "must be used to transmit formal educational programming); 47 C.F.R. §§ 74.931(b)-(d) (listing other permissible forms of ITFS programming); 47 C.F.R. § 74.931(f) (allowing licensees to "use excess capacity on each channel to transmit material *other than ITFS subject matter* . . . subject [to certain conditions]) (emphasis added).

[48] In re Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions, *Report & Order*, 13 F.C.C. Rcd. 19112, 19114 (1998) ("*MMDS Two-Way Order").*

[49] In re Amendment of Parts 2, 21, 74 and 94 of the Commission's Rules and Regulations in Regard to Frequency Allocation to the Instructional Television Fixed Service, the Multipoint Distribution Service, and the Private Operational Fixed Microwave Service, *Report & Order,* 94 F.C.C.2d 1203, 1250 (1983).

hindering MDS and ITFS licensees from providing competitive service options, the Commission acted decisively to give those licensees the flexibility they needed in order to flourish.[50]

Here, the Commission is faced with a similar situation. MSS systems in the 2 GHz band will be unable to provide "city-like" telecommunications in rural and unserved areas unless the Commission allows them to provide services in the city. Just as it has done with many services in the past, the Commission should give 2 GHz MSS licensees the tools they need to make the promised public interest benefits a reality.

There is also specific precedent for permitting a satellite service to reach urban customers through an ancillary terrestrial component. It has been nine years since the Commission first considered allowing Digital Audio Radio Services ("DARS") licensees to use terrestrial "gap fillers" to reach "urban canyons and other areas where it may be difficult to receive DARS signals transmitted by satellite."[51] When these "gap fillers" were most recently proposed, the Commission wondered, as it has here, whether "there comes a point at which the service becomes essentially a terrestrial rather than a satellite service."[52] Despite this concern, the Commission has proposed to permit the deployment of DARS gap fillers on an as-needed basis,[53] noting that the repeaters would operate on the satellites' assigned frequencies and would be used only "to improve service link margin in difficult propagation environments, especially in urban

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50 *MMDS Two-Way Order*, 13 F.C.C. Rcd. at 19115 (1998) ("[O]ur goals in instituting this proceeding were to facilitate the most efficient use of the affected spectrum, to enhance the competitiveness of the wireless cable industry, and to provide benefits to the educational community through the use of two-way services, such as high-speed Internet service.").

51 In re Establishment of Rules & Policies for the Digital Audio Radio Service in the 2310-2360 MHz Frequency Band, *Report & Order*, 12 F.C.C. Rcd. 5754, 5810 (1997) ("*DARS Order*").

52 In re Establishment of Rules & Policies for the Digital Audio Radio Service in the 2310-2360 MHz Frequency Band, *Notice of Proposed Rulemaking*, 11 F.C.C. Rcd. 1, 18 (1996).

53 *DARS Order*, 12 F.C.C. Rcd. at 5812.

areas."[54] Similar precedent exists for a footnote to the Table of Allocations that the Commission proposes in order to implement the ATC proposal; existing footnote US309 already authorizes ancillary terrestrial services in spectrum that is otherwise devoted to the aeronautical mobile-satellite (R) service ("AMS(R)S").[55]

Finally, the Commission's ATC proposal is fully consistent with Section 303(y) of the Communications Act.[56] Section 303(y) does nothing more than state explicitly what has long been implicit in the Act's structure: The Commission has discretion to allocate frequencies to various classes of radio use, provided such flexible use is consistent with US international agreements, is in the public interest, is not likely to deter communications investment, and will not result in harmful interference among users.[57] To implement the ATC proposal, the Commission needs simply to recognize—as it did in its initial 39 GHz *Report and Order*[58]—that ATC is consistent with international agreements, in the public interest, unlikely to create harmful interference, and likely to stimulate investment by allowing "flexibility in the design of . . . systems to respond readily to consumer demand."[59]

[54] *Id.* at 5811.

[55] 47 C.F.R. § 2.106.

[56] *See* 47 U.S.C. § 303(y).

[57] *Id.*; *see also* In re Allocation of Spectrum Below 5 GHz, *Second Report & Order*, 11 F.C.C. Rcd. 624 (1995), *aff'd*, 13 F.C.C. Rcd. 23830, 23835 (1998) (creating—two years prior to the enactment of Section 303(y)—a "flexible, broadly defined service" band to accommodate virtually any terrestrial fixed or mobile service).

[58] 12 F.C.C. Rcd. 18600 (1997).

[59] *Id.* at 18616.

IV. THE ALTERNATIVE OF CREATING AN INDEPENDENT TERRESTRIAL SERVICE IN THE MSS SPECTRUM WOULD BE TECHNICALLY AND ECONOMICALLY INFEASIBLE, AND WOULD FAIL TO ACHIEVE THE COMMISSION'S POLICY GOALS.

In addition to the primary proposal contained in the NPRM, the Commission also seeks comment on the alternative of taking some of the 2 GHz and L-band MSS spectrum, "separat[ing it] from the MSS operations in the bands," and assigning it by auction to a stand-alone terrestrial operator.[60] An independent terrestrial service would fail to achieve the Commission's policy goals, and would in fact undermine those goals. An independent terrestrial service would not remedy the signal problems that have plagued MSS; on the contrary, it would make MSS completely unavailable in urban areas. An independent terrestrial service would not promote rural deployment; on the contrary it would cripple MSS and ensure that rural Americans are left without digital wireless voice and data service for the indefinite future. An independent terrestrial service would not pave the way for new applications that require a single platform in rural and urban areas, nor would it enhance spectrum flexibility; on the contrary it would overconstrain both the terrestrial and satellite networks, essentially pretending that sharing is possible when it is not.

But the alternative proposal is not *merely* ineffective in policy terms; it is actually infeasible, inefficient, contrary to the public interest, and (insofar as auctions might be used for MSS spectrum) illegal.

[60] NPRM ¶¶ 37-40. In theory, this service *could* be offered "in conjunction with MSS Systems," NPRM ¶ 37, presumably on a dual-band roaming basis. However, the NPRM makes clear that the alternative terrestrial service need not be affiliated or integrated with the MSS network in any way, *see id*., so we analyze it as a completely independent service.

A. An Independent Terrestrial Mobile Service Would Be Technically Infeasible and Economically Inefficient.

The Commission's traditional policy of keeping Mobile and Mobile-Satellite Services separate is based on very real and very severe interference problems. The same frequencies simply cannot be used by both a satellite operator and an independent, unaffiliated terrestrial operator in the same place at the same time. Furthermore, satellites cannot practically provide coverage of rural areas without simultaneously covering urban areas. Although these problems can be managed in an integrated network, where a single network operator controls the resources available to both the satellite and terrestrial components, the problems force interference and capacity trade-offs that simply cannot be efficiently handled where two unaffiliated operators with conflicting economic incentives are involved.

In its March 8 *Ex Parte* Letter, New ICO sketched out four very general network architectures that a single network operator might use to incorporate both satellite and terrestrial components in a single MSS network.[61] Regardless of which architecture is used, an independent terrestrial operator would have to confront at least one of two main sharing problems: sharing the uplink spectrum, or sharing the downlink spectrum. Both are fraught with difficulties.

First, to the extent that the terrestrial operator's users transmit in the MSS uplink spectrum, the sensitivity of the satellite link will impose a fairly low limit on the number of simultaneous terrestrial users that can be accommodated. Assuming New ICO's system design and a CDMA 1X terrestrial approach, harmful interference to the MSS network might begin to occur with as few as 18 handsets per 1.25 MHz per satellite beam operating outdoors (with clear

[61] New ICO March 8 *Ex Parte* at 8; *id*. at Appendix B.

line of sight to the satellite), at maximum power and with active users (voice present).[62] On a nationwide basis this would be the equivalent of roughly 110 simultaneous outdoor users for the entire United States in that 1.25 MHz – certainly not enough to support a stand-alone terrestrial service in even just the *major* cities.

Second, to the extent that either the ATC base stations or the terrestrial-mode handsets are using the MSS downlink spectrum, the terrestrial operations will create "exclusion zones" of approximately 32 km in radius from any given base station or approximately 11 km from any ATC handset. Within these exclusion zones, satellite-only user equipment simply would not work. In the aggregate, these exclusion zones would make the MSS frequencies practically unavailable for satellite service virtually anywhere east of the Mississippi River or in the Pacific Coast states.

A single operator running an integrated MSS network would be able to mitigate these interference problems in ways that simply are not available when two independent operators are involved. To illustrate this, consider the "Forward Band" sharing mode, in which ATC base stations transmit on the MSS downlink frequencies and the ATC-mode handsets use MSS uplink frequencies. As stated above, the aggregate interference from ATC-mode handsets will begin to degrade normal MSS service once there are more than 18 ATC-mode handsets per 1.25 MHz per beam – 18 simultaneously voice-active, outdoor, full-power ATC-mode users. Naturally, not all of the ATC-mode handsets in use at a given time on the network will be voice-active, outdoors, and operating at full-power. As a consequence, statistical assumptions must be made in order to derive the number of simultaneous ATC users who can be accommodated without swamping the MSS network.

[62] To the extent that the operator attempts to place ATC *base stations* in the uplink spectrum, the problem is even more severe.

From the maximum number of simultaneous users and the average traffic generated by each user, the maximum number of ATC *subscribers* can be derived. However, note that if the MSS operator is not in control of the terrestrial portion of the network (*i.e.*, the MSS operator lacks the power to deny service when a terrestrial handset attempts to access the network), then statistical assumptions will have to be based on worst-case scenarios. By contrast, a single operator in control of both the satellite and terrestrial components will be able to assume the average case and make adjustments in real time for statistical variations around the mean. As a result of just this factor alone, an integrated MSS operator would be able to accommodate up to 84% more ATC users in the same spectrum than an independent terrestrial operator would be able to accommodate.[63]

Furthermore, an integrated MSS operator would be able to implement certain operational mitigation measures that would not be possible for an independent terrestrial operator. For example, an integrated network operator could harmonize the selection of satellite channels in each beam with the ATC channel plan. Because of the frequency reuse patterns employed in the satellite component, channels being used in one beam are already unavailable in adjacent beams. Therefore, in any given beam, the ATC can operate on channels that are unavailable to the satellite network. This would permit the operator to relax somewhat the upper limit on the number of ATC-mode handsets because the operator would be able to serve additional ATC-mode users on channels that would not overlap with the network's satellite component; the limiting interference concern for those channels would be interference into *adjacent* beams. Such integrated network control would not be possible between unaffiliated satellite and terrestrial networks. New ICO calculates an efficiency gain of up to 175% just from the

[63] The example is presented in a more technically and mathematically rigorous way in Appendix A.

techniques described thus far. In the example discussed in Appendix A, the cumulative effect of these two techniques would be to permit New ICO to serve through terrestrial means and without any impact to the satellite capacity approximately 1.6 million subscribers in 15 MHz, as opposed to just 580 thousand subscribers for an independent terrestrial network.

The interference problems noted above are so severe that the creation of *independent* terrestrial networks in MSS spectrum would inevitably lead to static band segmentation, which would waste spectrum and overconstrain both the terrestrial and the satellite networks. Capacity is money; hence, independent terrestrial and satellite operators would have no incentive to moderate their spectrum demands in order to accommodate the other network's traffic demands. Real-time adjustment of the amount of spectrum assigned to each network would be out of the question because of the independence of the operators, and the static division of resources that would result would almost certainly leave each network less able to meet its peak traffic demands, even if spectrum were plentiful on the other portion of the network. And even if the independent network operators could agree on a fair and workable division of spectrum between them, this arrangement would still fail to achieve the spectrum efficiencies of integrated ATCs. That is, a fixed amount of spectrum would be reserved for urban use, and would be *permanently* unavailable in rural areas, and even when urban traffic loads were quite low.

By contrast, an integrated MSS operator could use a dynamic resource management algorithm to adjust the amount of capacity devoted to the terrestrial and satellite components at any given time, in order to make sure that spectrum availability follows traffic volume. For example, relatively more capacity might be devoted to the ATCs during Friday afternoon rush hour, with relatively less capacity devoted to ATCs on Saturday morning. This concept is illustrated in Figure 7. ICO actually has developed, built, and installed a similar algorithm already. This system, installed at ICO's Satellite Access Nodes (SANs), produces resource plans for the ICO constellation that vary minute by minute, globally.[64] Dynamic resource management would permit an integrated MSS operator to accommodate ATC-mode users without adversely affecting normal satellite-mode communications – or alternatively during times of abnormally heavy demand, to ensure that resources are allocated in an orderly and equitable manner.

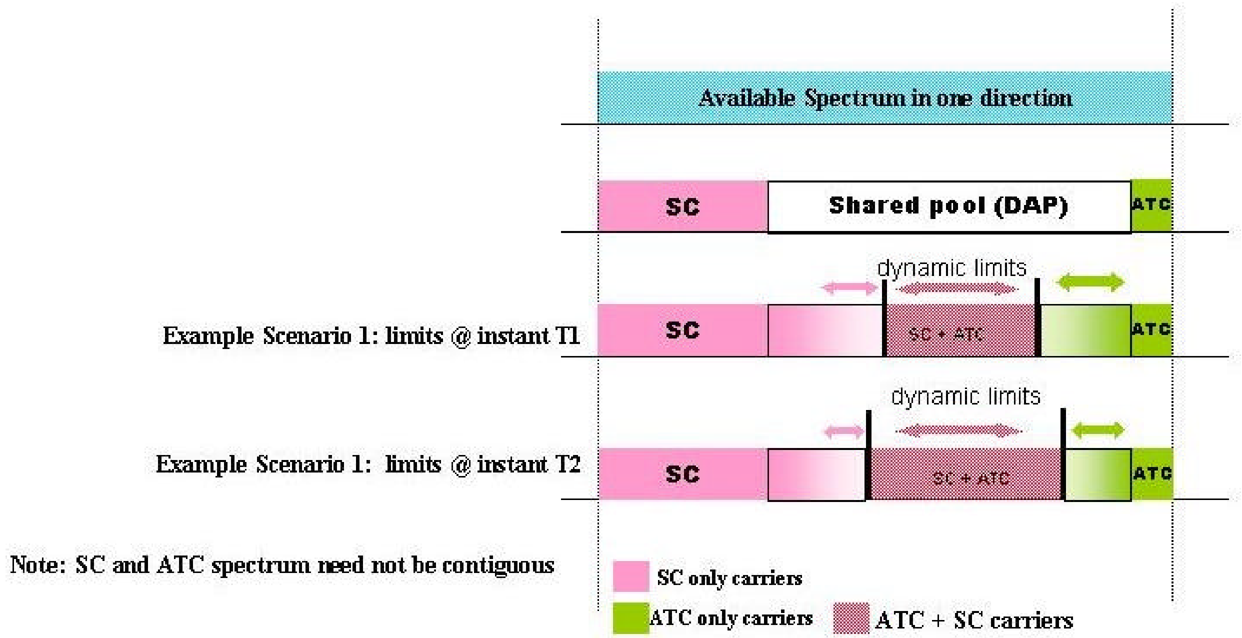

Figure 7: Dynamic Sharing – DAP

So far our example has dealt only with interference on the MSS uplink frequencies, but similar considerations apply in the MSS downlink. For instance, in the forward band scenario, a judicious choice of the downlink channels assigned to a given beam at a given point in time, and of the ATC channels used by base stations in the fringes of the area where ATC is used, would

64 ICO's existing system for dynamically managing spectrum resources in described in Appendix B.

allow substantial reductions in the "buffer area" where ATC is not provided and where handsets receiving from the satellite would be subject to interference.

And although the examples above deal with just two independent network operators, there would of course be a relatively large number of local terrestrial network operators, each presumably with the freedom to design its terrestrial network however it sees fit. As a practical matter, under the alternative proposal, each MSS operator would be required to share not with just one independent terrestrial operator, but with many. The task of simultaneously mitigating so many different types of terrestrial interference within a satellite beam is simply impossible.

The inescapable conclusion is that an independent terrestrial network using MSS spectrum must either be so robust that it prevents MSS from using the band, or so constrained that no one would bother to build it. No realistic middle ground exists. Moreover, even if the FCC could essentially design both systems in minute detail and require strict adherence to the government-imposed technical specifications, it is difficult to imagine any result more at odds with federal spectrum management policies. Instead of embarking on such acute micromanagement, the Commission should adopt its primary proposal for fully integrated ATCs, and rely on a unity of economic interest to solve the challenging interference problems that inevitably accompany more intensive use of the spectrum.

B. The Commission Cannot Grant Terrestrial Mobile Licenses Without Gutting the Recent 2 GHz MSS Licenses.

As noted above, the use of the same frequencies by both a satellite network provider and an independent, unaffiliated terrestrial network provider in the same place at the same time is unworkable. Hence, if the Commission were to authorize a stand-alone terrestrial operator to use MSS frequencies in the Los Angeles area, the Commission would need to remove Los Angeles from the authorized service area of any MSS operator using those frequencies. This would turn the once-nationwide MSS service area into so much swiss cheese. The consequences for the marketplace and for public policy would be disastrous.

It would be disastrous economically because the key problems in the MSS industry already stem from the inability to capture scale economies with first-generation MSS networks. Eliminating millions of potential urban subscribers, in cities all over America, would only exacerbate the problem. Just as the addition of an *integrated* ATC help solve the "market size problem" and the "product investment problem," the *elimination* of previously granted spectrum rights in order to make room for an *independent* terrestrial service would have just the opposite effect: It would lower demand even further, which would discourage product investment, which would raise prices, which would lower demand, and so on.

Geographic segmentation would also be a public policy disaster: A service created with the express goal of providing coverage *everywhere* would be made expressly unavailable in the largest cities. In effect, MSS operators would be *forbidden* from achieving the very purpose for which MSS was designed. Moreover, because no one would build such a constrained service, no possible public interest benefit could justify such a dismantling of the MSS sector.

In the real world, there is probably no one who thinks this "swiss cheese" approach to an independent terrestrial network would make very much sense. Consequently, if the Commission were to adopt the "alternative proposal" for a stand-alone terrestrial service, the inevitable result would be band segmentation.[65] But the economic effects of this route on the MSS industry

[65] Although in theory this could take the form of segmenting individual MSS spectrum assignments (which are already too small), the more realistic possibility would be to segment the MSS band into a terrestrial portion and a satellite portion, and then redistribute assignments within each portion. This would be tantamount to reallocation of the band, which is under consideration in Docket No. 00-258. New ICO has forcefully opposed any such reallocation in that proceeding, *see* Comments of New ICO Global Communications in ET Docket No. 00-258 (filed October 22, 2001), and will not repeat all of the arguments against reallocation here. Suffice it to say that such a reallocation in the 2 GHz MSS band at this time would represent an arbitrary and unprecedented departure from policies the Commission has followed for more than ten years and the licenses the Commission issued just three months ago.

would be much the same. The "alternative proposal" forces the Commission to destroy the economic viability of existing MSS operators with newly minted licenses, either by cutting holes in their service area, or by taking away spectrum. Either path leads to the ruin of an entire industry, to the detriment of rural Americans who will, under such circumstances, remain unserved indefinitely.

C. Spectrum Used for MSS Cannot and Should Not Be Auctioned.

As the Commission noted in the NPRM (¶ 39), the primary ATC proposal will avoid mutually exclusive applications and hence the need for any auctions. This feature of the Commission's primary proposal should be dispositive under section 309(j)(6), which requires the Commission to avoid mutual exclusivity whenever possible. Although the statute clearly does not mean that it is impermissible to use an auction simply because a non-auction alternative is available,[66] it must at least mean that when one proposal is preferable on every relevant policy ground *except* the amount of money generated for the U.S. Treasury, it is impermissible for the Commission to reject that proposal by elevating auction considerations above all else. If the statute does not hold that meaning, then it is difficult to give it any meaning at all, and courts will not construe a statute to be completely "inoperative or superfluous, void or insignificant."[67] And as the Commission has already noted, the nature of international satellite services and the difficulties of multilateral coordination suggest that the Commission should strive to avoid auctions in satellite spectrum.[68]

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66 *See Bachow Communications, Inc. v. FCC,* 237 F.3d 683, 691-92 (D.C. Cir. 2001).

67 *C.F. Communications Corp. v. FCC*, 128 F.3d 735, 739 (D.C. Cir. 1997.

68 *See* In re Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended, *Notice of Proposed Rulemaking*, 14 F.C.C. Rcd. 5206, 5240 ¶ 65 (1999); *see also* In re Amendment of Part 25 of the Commission's Rules to Establish Rules and Policies Pertaining to the Second Processing Round of the Non-voice, Non-geostationary Mobile Satellite Service, *Notice of Proposed Rulemaking,* 11 F.C.C. Rcd. 19841, 19869 ¶ 80 (1996).

But even if the Commission were to adopt the alternative of creating an independent terrestrial service, it would still be at least imprudent, and at worst illegal, to assign that spectrum by auction. First, it would be impermissible under the Open-Market Reorganization for the Betterment of International Telecommunications ("ORBIT") Act.[69] The ORBIT Act expressly bars the Commission, "[n]otwithstanding any other provision of law," from using competitive bidding to assign "spectrum used for the provision of international or global satellite communications services."[70] If independent terrestrial licenses could be granted in the 2 GHz MSS spectrum without interfering with the provision of 2 GHz MSS, then perhaps the ORBIT Act would not apply because satellite service in the band would remain undisturbed. But in this proceeding the services are incompatible and any spectrum rights the government might sell would have to be taken from the satellite licensees who currently have exclusive use of the band. It would plainly be "spectrum used for the provision of international or global satellite communications services," and competitive bidding would be barred under the plain language of the ORBIT Act.

A very similar prohibition was at issue in a case recently decided by the U.S. Court of Appeals for the D.C. Circuit. In *National Public Radio v. FCC*, the court made clear that when Congress specifically creates exemptions from competitive bidding procedures, the Commission must take that statutory exclusion seriously.[71] *National Public Radio* compared Congress's general intent that mutually exclusive applications be resolved by auctions against Congress' specific instruction that non-commercial educational broadcasters ("NCE"s) not be required to

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69 106 P.L. 180, 114 Stat. 48,, *codified at* 47 U.S.C. § 765f.

70 47 U.S.C. § 765f.

71 *See National Public Radio v. FCC*, 254 F.3d 226, 228-31 (D.C. Cir. 2001).

participate in auctions.[72] The Court noted that the general intent to require auctions is "subject" to the specific limitation that "expressly denies the Commission authority to hold auctions for 'licenses . . . issued . . . for [NCEs].'"[73] Although the ORBIT Act prohibition applies to satellite spectrum rather than satellite licensees, the result is the same: this spectrum cannot be assigned by competitive bidding.

If the Commission adopts its primary proposal, there will be no system of competitive bidding and section 309(j)(3) will not come into play at all. However, because section 309(j)(3) was raised in the NPRM,[74] New ICO notes that the policy goals Congress mentioned in that section are fully consistent with the integrated ATC proposal rather than the auction of independent terrestrial systems. In particular, as previously noted, the integrated approach will use the spectrum more efficiently[75] and will spur the deployment of entirely new services for urban and rural Americans alike, rather than lead to the creation of just another urban PCS network.[76]

In response to the "unjust enrichment" concern,[77] the Commission must recognize that satellite service providers must pay enormous up-front development costs that would make any claim of "windfall" here specious. New ICO's shareholders have already invested fully $3.7 billion for the global network New ICO plans to deploy, and have committed another $1.4 billion to vendors. An additional $3.5 billion is estimated to be necessary in order to get the service launched. Although the U.S. Treasury does not immediately benefit from ICO's multi-billion-

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72 *Id.* at 227-28.

73 *Id.* at 229.

74 NPRM ¶ 40.

75 See 47 U.S.C. § 309(j)(3)(D).

76 See 47 U.S.C. § 309(j)(3)(A).

77 See 47 U.S.C. § 309(j)(3)(C); NPRM ¶ 40.

dollar investment in satellites and ground stations, the millions of Americans who live outside of traditional terrestrial wireless coverage areas will. In a sense, ICO and other 2 GHz licensees will be paying for their spectrum by providing services that auction-winners refuse to provide. And, as the Court of Appeals for the D.C. Circuit noted in *National Public Radio*, the creation of Treasury revenues from competitive bidding is not the be-all and the end-all of Congressional intent.[78]

Finally, the Commission has decisively rejected the claim that providing additional spectrum flexibility to a non-auctionable service represents a "windfall," in the recent order adding a Mobile allocation to the MMDS/ITFS frequencies.[79] This is sound policy. Additional flexibility improves spectrum efficiency no matter how individual licenses are acquired,[80] and denying flexibility to non-auctionable services would artificially restrict the Commission's pursuit of the spectrum flexibility policies that undeniably work to the benefit of the American public. And even in non-auctionable services like the MSS, many licenses may be owned or controlled by investors who essentially "bought in" on the secondary market, as some of New ICO's investors have done. There is no basis for thinking that conferring additional flexibility is fair when the licensee paid the Treasury but unfair when the licensee paid a previous owner. As

78 *See National Public Radio*, 254 F.3d at 230 ("Most important, notwithstanding Congress' desire to increase revenue, it expressly exempted NCEs from participating in auctions, thus demonstrating that it understood that pursuit of this goal would be limited by the NCE exemption.").

79 *See* First Report & Order & Memorandum Opinion & Order, Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services, ET Docket No. 00-258 (rel. Sept. 24, 2001), at ¶¶ 21, 27 (describing the "vibrant" secondary market for MMDS licenses and for ITFS spectrum generally, and rejecting the claim that spectrum flexibility for a non-auctioned service represents a "windfall").

80 Indeed, in terms of economic efficiency, it is practically irrelevant how a license is awarded, as long as it can be transferred on the secondary market. *See generally* Notice of Proposed Rulemaking, In re Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, WT Docket No. 00-230, ¶ 19 (rel. Nov. 27, 2000).

a matter of precedent, some of the Commission's most important decisions on spectrum flexibility have involved services that were never subject to auction.[81]

In summary, the alternative proposal for independent terrestrial licenses in cities across the United States would make almost no positive contribution to the public interest. It would be inferior to the primary proposal for integrated ATCs because it would:

- not remedy the urban signal problem facing MSS networks;
- not facilitate the delivery of new services to Americans in rural and high-cost areas;
- not facilitate the development of new digital services that depend on the availability of a common platform in both rural and urban areas;
- not increase spectrum flexibility;
- not remedy the fundamental spectrum inefficiency that results from using some bands for "urban-only" service and different bands for "rural-only" service;
- not use the spectrum as efficiently as an integrated MSS network with ATCs would;
- not be consistent with the recently granted 2 GHz MSS licenses, or the ten-year effort by the United States to obtain a harmonized 2 GHz MSS allocation;
- not be faithful to the Commission's duty to avoid mutual exclusivity where possible;
- not be consistent with the ORBIT Act; and

[81] *See* In re Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services, *First Report & Order & Memorandum Opinion & Order*, ET Docket No. 00-258 (rel. Sept. 24, 2001); In re Digital Data Transmission Within the Video Portion of Television Broadcast Station Transmissions, *Report and Order*, 11 F.C.C. Rcd. 7799 (1996).

- not be consistent with the policies embedded in the Commission's statutory auction authority.

There is, in short, practically nothing to be said in favor of the alternative proposal. It should be swiftly rejected.

V. NEW ICO SUPPORTS SUBSTANTIALLY ALL OF THE COMMISSION'S NON-TECHNICAL REGULATORY PROPOSALS, BUT URGES THE COMMISSION TO RECOGNIZE MORE CLEARLY THAT SERVICE VIA ATCS IS MOBILE SATELLITE SERVICE.

In its March 8 *Ex Parte,* New ICO cautioned the Commission against a possible "spectrum grab," and proposed "that ATC only be operated in conjunction with a launched *and commercially operating* satellite system. Without this limitation, a terrestrial mobile operator might attempt to buy up MSS licenses and construct terrestrial facilities in urban areas without providing any satellite service at all."[82] In fact, terrestrial CMRS operators are already attempting to convert the 2 GHz MSS spectrum for terrestrial use. For this reason, the FCC must ensure that ATCs remain truly ancillary to MSS.

The Commission has correctly teed up the "ancillary" question by focusing on the character of the service rather than attempting to quantify traffic loads over the satellite and terrestrial components of the network. In particular, the Commission determined correctly that any terrestrial component of an MSS network should be considered "ancillary" if it (a) uses assigned MSS frequencies, (b) to provide services that are substantially the same (from the consumer's point of view) as those provided over the satellite-only portion of the network, in areas where (c) the satellite signal is attenuated and could not be reliably received without the help of ATCs.[83]

[82] New ICO March 8 *Ex Parte* at 7.

[83] NPRM ¶ 30.

New ICO also supports the Commission's proposals to allow ATC operations only after satellite coverage has been achieved, and only so long as satellite coverage is maintained. Specifically, it is reasonable to require initial satellite coverage of all fifty states, Puerto Rico, and the U.S. Virgin Islands prior to commencement of ATC service.[84] It may be more appropriate, however, to apply this coverage requirement in terms of satellite visibility above 5 degrees rather than in terms of whether the MSS network "provides mobile satellite service" within the coverage area,[85] or of the network's "commercial availability."[86] Coverage conditions are a matter of geometry, and therefore provide a "bright line" test superior to any standard premised on "commercial availability."[87]

In addition, it is also reasonable to require that any satellite outages be remedied promptly.[88] ICO suggests three months as a reasonable replacement deadline, suitable for all but the most unexpected outages. This may have the practical effect of requiring in-orbit spares for any MSS system that intends to use ATCs, a reasonable result that would essentially require MSS operators to spend at least as much on MSS network redundancy as they spend on any ancillary terrestrial facilities. MSS operators that do not wish to use in-orbit sparing are not, after all, required to implement ATCs.

New ICO notes with some concern, however, the Commission's apparent proposal to allow L-band MSS operators to operate ATCs even in areas outside the coverage of their MSS

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84 NPRM ¶¶ 32, 42.

85 NPRM ¶ 77.5

86 NPRM ¶ 32.

87 *Cf.* In re Amendment of the Commission's Rules to Establish Rules & Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands, *Report & Order*, 9 F.C.C. Rcd. 5936, 5947-48 ¶¶ 24-25 (1994).

88 NPRM ¶ 45.

networks, and even to waive the coverage requirement for L-band GSO networks.[89] This seems to be a departure from the ATC concept, which as the Commission notes is intended to augment MSS signal availability in urban areas where buildings keep an otherwise-present MSS signal from being received.[90] If an MSS provider has built its business around oceanic coverage but is unable to provide satellite service on the Mississippi River, then it is unclear why that provider should be authorized to build what is essentially a stand-alone cellular service in St. Louis. ATCs, after all, will be defined as MSS under the Commission's primary proposal, and they should only be permitted in the areas where MSS may be offered. New ICO urges the Commission to apply the 100% coverage requirement even-handedly for all MSS networks, and to avoid creating loopholes for stand-alone terrestrial systems unrelated to any MSS network.

The public interest would not be served by requiring all traffic to be routed through a central data switch.[91] First, there seems to be no affirmative reason for such a requirement. It would not in any way limit the use of ATCs (if that was the intention); it would not make the ATC and satellite components more integrated; it would not ensure that the terrestrial component remains ancillary to an MSS network. Moreover, such a requirement would make the service more vulnerable to outage by creating a single point of failure for all traffic in the network. At the same time, a central data switch requirement would make MSS service more expensive, essentially *forbidding* network engineers from using least-cost routing. In addition, a central data switch requirement would be tantamount to FCC micromanagement of the MSS networks, and would contravene the Commission's general policy of granting licenses technical,

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[89] NPRM ¶ 43.

[90] *See* NPRM ¶ 30.

[91] NPRM ¶ 45.

operational, and service flexibility.[92] Consistent with Commission precedent, the public interest is always better served by allowing MSS operators rather than regulators to decide how best to route telecommunications traffic on their networks.

The Commission asks whether satisfaction of the initial coverage requirement is sufficient as well as necessary, *i.e.*, whether ATC service could be commenced even before all satellites are launched if the coverage requirement has been satisfied.[93] New ICO believes the answer should be yes. The explicit construction and launch milestones in each 2 GHz MSS license already ensure that each licensee will deploy its full constellation within a reasonable time. Requiring full deployment in addition to 100% coverage penalizes the operators with the most robust constellations, contrary to the public interest.

Moreover, buildout and testing of ATCs should definitely be permitted prior to the achievement of the coverage conditions.[94] The practical difficulties associated with integrating and testing the ATC element after placing the satellite component in operation would be substantial. Moreover, the time required for ATC construction alone would make it impossible as a practical matter for MSS operators to use ATCs for more than a year after they are legally permitted to do so. And during that time, the MSS offering would suffer from all the same problems that have proven to be such formidable obstacles to the commercial success of first-generation MSS networks. In short, delaying buildout and testing would defeat the purpose of the rest of the proposal. If the Commission is looking for some demonstration of the MSS operator's *bona fides* before ATC buildout is permitted, then perhaps ATC buildout should be

[92] *See, e.g., Spectrum Policy Statement*, 14 F.C.C. Rcd. 19868 (1999); *Secondary Markets Policy Statement*, 15 F.C.C. Rcd. 24178 (2000).

[93] NPRM ¶ 44.

[94] NPRM ¶ 45.

permitted at any time after the MSS network achieves coverage of the required area for at least 20% of the time.

New ICO also supports the Commission's proposals on the geographic scope of ATC authorizations and the manner in which they are granted (*i.e.*, as part of a comprehensive MSS authorization). Specifically, the Commission should allow ATC operations anywhere within the fifty states, Puerto Rico, and the U.S. Virgin Islands, and this authority should be granted pursuant to the same procedures used to license the space stations.[95] In both cases, the Commission's suggested approach follows logically from the fact that ATC operations will be *defined as MSS* under the Commission's proposal. Because ATC operations are MSS, they should of course be permitted wherever MSS is permitted, and pursuant to the same authorization. Similarly, authority to provide services via an ATC should be deemed lost whenever the broader MSS authorization is lost.[96] By the same ironclad logic, any agreement among licensees for the joint provision of MSS should be presumed to allow for the joint provision of ATC service.[97]

The NPRM seeks comment on the extent to which coordination of individual ATC base stations will be required.[98] New ICO believes that ATC base stations in the 2165-2200 MHz band will need to be coordinated with co-channel and adjacent-channel stations in the terrestrial fixed service. But this does *not* require the cumbersome step of individually licensing each ATC base station. Rather, coordination can be accomplished as it is in PCS spectrum – via the

95 NPRM ¶¶ 50-51.

96 NPRM ¶ 48.

97 NPRM ¶ 48.

98 NPRM ¶ 52.

maintenance of a comprehensive, continuously updated list of station locations.[99] There is, however, no need for coordination with adjacent-channel MSS operators. The existing FS in and near the 2165-2200 MHz band are constrained below a power emission mask equal to –43 dBW in 4 kHz at the transmitter output.[100] If the ATC emission limits are aligned to those used for Broadband PCS,[101] as the Commission proposes,[102] then the sideband power will be below –43 dBW in 1 MHz at the transmitter output (*i.e.*, a reduction of 24 dB). These proposed out-of-band ATC levels are well below those produced by existing fixed emitters, and currently there is no need to coordinate these fixed stations in order to ensure protection of MSS handheld receivers. Therefore, there is also no need to coordinate the ATC base stations with other MSS licensees. New ICO supports the Commission's proposal to require handset certification pursuant to Part 2, Subpart J of the Commission's rules.[103]

New ICO supports the Commission's proposal to add a new footnote to the U.S. Table of Allocations, clarifying that MSS providers may use an ATC in their delivery of MSS services in the 2 GHz bands. While not strictly necessary, such a footnote would give other potential users of the band notice of the types of operations authorized under the MSS rubric at 2 GHz (and possibly in other bands as well). New ICO suggests language such as the following (modeled on footnotes US 309 and US 327) for the 1990-2025 MHz and 2165-2200 MHz bands:

> USxxx: Mobile-satellite service operations in this band are permitted to include, on a co-primary basis, transmissions between terrestrial base stations and terrestrial mobile units, in order to extend or supplement mobile-satellite service operations. Such ancillary use of terrestrial mobile communications is limited to

[99] *See* 47 C.F.R. § 24.415(j).

[100] 47 CFR § 21.106 and § 101.111

[101] 47 CFR § 24.238.

[102] NPRM ¶ 55, discussed *infra.*

[103] NPRM ¶ 53 (citing 47 C.F.R. § 2.1031 *et seq.*).

> operators of stations in the mobile-satellite service in areas where they have the capability to provide satellite-based service.

In New ICO's opinion, existing footnotes NG156 and NG168 do not achieve the same purpose, largely because they leave the terrestrial service in a secondary position and fail to distinguish between ancillary terrestrial communications and any other kind of communications.

Finally, New ICO believes the Commission should be very wary of adding new terrestrial fixed and mobile allocations to the Table, for three reasons. First, new allocations are unnecessary to facilitate the integrated ATC approach. In both the DARS case and the AMSS case, the Commission has used footnotes to the Table of Allocations in order to grant primary status to terrestrial communications that extended the reach of satellite networks. Second, the Commission just finished a lengthy rulemaking governing the relocation of terrestrial FS incumbents at 2 GHz in both the uplink and the downlink bands. Those incumbents are currently scheduled to become secondary as of 2010. Adding new co-primary fixed and mobile allocations to the band now would undo years of work on relocation and leave the band full of fixed microwave systems for the indefinite future. Third, adding terrestrial allocations to the band on a full-fledged co-primary basis could tend to undercut any Commission effort to ensure that ATCs remain truly ancillary to the operation of integrated MSS networks. The advantage of a footnote approach is that it preserves the MSS spectrum the Commission has been trying to secure for the last ten years, and allows terrestrial use only to the extent it is ancillary to MSS. By contrast, the addition of co-primary fixed and mobile allocations could undercut the Commission's policy goals regarding rural service and jeopardize the MSS sector's ability to realize all of the benefits the Commission has touted for so long. New ICO does not necessarily oppose the addition of a terrestrial mobile allocation, as long as other regulatory measures address New ICO's concerns about relocation and a "spectrum grab" by incumbent terrestrial operators.[104]

VI. TECHNICAL REGULATORY PROPOSALS.

The NPRM proposes specific rules for the operation of ATC base stations, including emission limits, tower height restrictions, transmit power restrictions, and frequency stability requirements.[105] ICO supports the Commission's proposals in each of these areas, specifically, Part 25 should be amended to require that ATC base stations operate in such a way that they would comply with sections 24.238, 24.232, 24.237, and 24.235 of the PCS rules.

VII. THE INTEGRATED ATC PROPOSAL DOES NOT REQUIRE A REVISION OF THE COMMISSION'S RELOCATION POLICIES FOR THE MSS BANDS.

In the NPRM, the Commission seeks comment on the extent to which adoption of the ATC proposal would require revision of its recently adopted relocation rules for either the uplink or the downlink band. Fortunately, the Commission's phased relocation policy is practically unaffected by the ATC proposal.[106]

In the uplink, as the Commission notes, the relocation of BAS incumbents out of channel 1 will leave clean spectrum in which MSS operators can provide MSS services, regardless of whether the services are delivered over the satellite component of the network or the ancillary terrestrial component.[107] Neither the phasing of the relocation nor the length of the negotiation

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[104] *See* Comments of New ICO Global Communications, In re Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems, ET Docket No. 00-258 (filed Oct. 22, 2001).

[105] NPRM ¶¶ 55-57.

[106] The point here is not that the Commission's basic policies on relocation are perfect or even adequate; it is simply that nothing about the ATC proposal requires any significant change.

[107] NPRM ¶ 74.

periods would require alteration. In the downlink, the Commission's rules require only the addition of TIA Bulletin TSB10-F as the appropriate standard for determining when a terrestrial incumbent is entitled to demand relocation on account of interference from an ATC, as the Commission proposes.[108]

The adequacy of the current relocation rules is premised on the overall band plan remaining as it is. New ICO is of course aware that a reallocation of MSS spectrum to terrestrial use has been suggested in the 2 GHz band.[109] If that were to occur, then indeed there might be a need to revise the relocation rules, depending on the amount of spectrum reallocated. However, the Commission has already determined, several times, that the rules currently in force are adequate to hold terrestrial incumbents harmless from the rollout of MSS services in the 1990-2025 MHz and 2165-2200 MHz bands. If the Commission were to decide to reallocate any portion of that spectrum to so-called "3G" services, in such a way as to impose additional burdens on either the MSS entrants or the terrestrial incumbents, then it would only be fair for the "3G" entrants to bear the cost of such a reallocation. New ICO urges the Commission to make sure that no such adjustment of the relocation rules is necessary.

VIII. CONCLUSION

This proceeding presents the Commission with an unusually stark choice between industries and policy goals. Adoption of the primary proposal to permit fully integrated ATCs will free up the MSS industry to use MSS spectrum -- spectrum already licensed to specific companies -- to achieve important policy goals like rural deployment and the development of new advanced services. The primary proposal will also further the Commission's broad policy

108 NPRM ¶ 76.

109 Introduction of New Advanced Mobile and Fixed Terrestrial Wireless Services, FCC 01-224 (rel. Aug. 20, 2001).

preference for greater spectrum flexibility, and will show that knotty problems like the lack of digital networks in rural America can indeed be addressed without complicated regulatory regimes for cross-subsidization. The other option is for the Commission to side with incumbent terrestrial mobile operators -- against flexibility, against rural service, and against the innovations that will certainly come with the arrival of a truly ubiquitous digital network.

In making this choice, the Commission must be guided by the law and the public interest, and on these grounds the better choice is quite clear. The Commission should adopt the primary ATC proposal and should do so promptly.

Respectfully submitted,

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APPENDIX A
Benefit of Integrating MSS Satellite/Ancillary Terrestrial Components

This Appendix demonstrates that integrating satellite and ancillary terrestrial components of a single network improves spectrum utilization compared to two independent networks. For purposes of this demonstration, the Forward Mode ATC concept will be assessed.

A worst-case analysis can be used to determine the number of terrestrial handsets that can simultaneously be in use within 1.25 MHz of an MSS beam without causing harmful interference to the satellite network, when these handsets are outdoors (direct line-of-sight to the satellite), at full power, and voice is present in each of them. The fact that a handset is in use does not imply that at any given instant a voice signal is present. This has a bearing on the power level being transmitted and is usually referred to as the "voice activation" factor.

As stated in section 5.7 of Appendix B of the submission made by New ICO on March 8, 2001, proposing ATC, the C/I (carrier-to-interference ratio) at the satellite corresponding to the interference from one such terrestrial user is 25.4 dB.

For an acceptable C/I of 12.8 dB, it can be concluded that the number N_0 of terrestrial handsets with the characteristics described above that could be simultaneously in use within an ICO beam is at most 18. For this number of users with the given characteristics, no excessive interference would be caused to a co-frequency signal in the SC (satellite component).

However, if the satellite and terrestrial operations are integrated into a single network, as in the integrated ATC concept, it is possible to accommodate more terrestrial use of the spectrum than if the two components of the network were operated independently. Among the several improvements that result from an integrated approach only two are considered here:

(i) the possibility of assuming average conditions, as opposed to the worst-case conditions that an independent operator is forced to assume;

(ii) harmonization of the selection of satellite channels in each beam and the ATC channel plan

Average Conditions Versus Worst Case Conditions

When determining the total number N of ATC handsets that would be allowed to be simultaneously in use in the same uplink beam, statistical variations in such factors as building blockage (indoor versus outdoor), handset power control, and voice activation should also be taken into account. Note that the term "outdoor" is used here somewhat loosely. An "outdoor" handset means a handset with direct line-of-sight to the satellite, and according to this definition many handsets that are not inside a building would nonetheless fail to qualify as "outdoor" (*e.g.* due to the presence of natural or man-made obstacles).

Both the independent and integrated terrestrial components could take advantage of these factors. The difference is that the integrated operator, having knowledge of all activity on the network, would be justified designing for the average benefit because it will be able to make adjustments in real time to accommodate the statistical variations. The independent operator, however, would have to design for worst-case conditions, *i.e.* conditions that will not lead to excessive interference except at most for a very small percentage of time. In the calculations that follow, it is assumed that instead of using the statistical average, the independent operator would design its system for the average plus 3σ, where σ is the standard deviation of the relevant probability distribution.

A model was developed in order to compare the total number of users per 1.25 MHz allowed in a beam for the independent and integrated terrestrial operators. Three factors are considered for each individual user – building blockage, voice activation, and power control. The building blockage factor (y_{ENV}) and voice activation factor (y_{DTX}) can be modeled as binomial random variables, while the power control factor (y_{PWR}) is modeled here to account for a Rayleigh faded path.

For a number N of ATC handsets in use, the effective number N_{eff} of handsets in use under the conditions described above (outdoor, voice present, full power) is given by

$$N_{eff} = \sum_{k=1}^{N} y_{ENV}^{(k)} \; y_{DTX}^{(k)} \; y_{PWR}^{(k)}$$

where:

$$y_{ENV}^{(k)} = \begin{cases} 1 & user\ outdoor \\ 0 & user\ indoor \end{cases} \qquad \text{(k=1,…N)}$$

are independent binomial random variables, with average p_{ENV} = E[$y_{ENV}^{(k)}$];

$$y_{DTX}^{(k)} = \begin{cases} 1 & user\ with\ active\ voice \\ 0 & user\ without\ active\ voice \end{cases} \qquad \text{(k=1,…N)}$$

are also independent binomial random variables, with average p_{DTX} = E[$y_{DTX}^{(k)}$]; and

$$y_{PWR}^{(k)} = \textit{power control multiplier with respect to maximum power}$$

is a random variable with values between 0 and 1 that compensates for fading assumed to follow a Rayleigh distribution with parameter β. Since $y_{PWR}^{(k)}$ is truncated at 1, the average value m_{PWR} = E[y_{PWR}] can be written as

$$E[y_{PWR}] = m_{PWR} = \int_0^1 \frac{1}{2b^2 Y} e^{-1/2b^2 Y} dY + (1 - e^{-1/2b^2})$$

while the mean square value is

$$E[y_{PWR}^2] = \int_0^1 \frac{1}{2b^2} e^{-1/2b^2 Y} dY + (1 - e^{-1/2b^2})$$

In the average approach, suitable for integrated operators, the total number of simultaneous users (N_D) that can be in an uplink beam can be determined using

$$N_0 = E[N_{eff}] = N_D \; p_{ENV} \; p_{DTX} \; m_{PWR}$$

where, as described above, N_0 is the maximum number of simultaneous users that are outdoors, at maximum power and with voice present.

In the worst-case approach, required for independent operators, the total number of simultaneous users (N_I) that can be in an uplink beam can be determined using

$$N_0 = E[N_{eff}] + 3s_{N_{eff}} = N_I \; p_{ENV} \; p_{DTX} \; m_{PWR} + 3s_{N_{eff}}$$

where,

$$s^2_{N_{eff}} = E[N^2_{eff}] - \left(E[N_{eff}]\right)^2 = N_I \left(p_{ENV} \, p_{DTX} \, E[y^2_{PWR}] - p^2_{ENV} \, p^2_{DTX} \, m^2_{PWR}\right)$$

Representative values for the average of the building blockage, voice activation and power control factors are -10-dB, -2-dB and -2-dB, respectively. Then the integrated terrestrial component would be able to accommodate 452 simultaneous users per beam. The independent operator, designing for an inflexible limit, would only be able to accommodate 245 simultaneous users.[1] This means that only because of this feature, the integrated operator improves spectrum utilization by 84% with respect to the independent operator.

It is to be noted that the numbers of users mentioned above are per satellite beam and per 1.25 MHz. In order to estimate the total number of subscribers that could be served in the continental United States, three further assumptions are introduced:

(i) We assume, as an example, that 15 MHz of spectrum are available and that 10 channels of 1.25 MHz can be accommodated in this spectrum. This means that the above numbers can be multiplied by a factor of 10.

(ii) Simulations were conducted to relate the number of users per beam to the number of users in the continental United States. It was concluded that the latter equals the former multiplied by a factor of approximately 6.

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[1] For m_{PWR} = 0.63 (-2 dB), β is determined to be 1.0784, from which $E[y^2_{PWR}]$ is found to be 0.5082

(iii) Finally, in order to derive the number of subscribers that could be served in the continental United States from the number of simultaneous users, it is assumed here that the average traffic per subscriber is 25 mE.

As a result of (i), (ii), and (iii) above, the multiplying factor is

$$10 \times 6 \times (1/0.025) = 2400$$

The integrated operator would be able to serve 1,085,000 subscribers (590,000 for the independent operator), only by assuming average conditions rather than the worst-case conditions (average plus three standard deviations) that the independent operator would be forced to assume.

Harmonization of Frequency Selection

Also available to a tightly integrated terrestrial operator would also be able to dynamically adjust ATC channel loading dependent on the instantaneous satellite component frequency plan, which is highly dynamic. The ICO system reuses frequencies with a 4:1 beam pattern, which must nominally be coordinated between satellites in different planes as well as between satellites in the same plane. To increase the capacity of the ATC, a covering satellite beam could be assigned spectrum that permits non-overlapping ATC spectrum to increase the number of users up to the point where harmful interference in adjacent satellite beams would start to occur.

As before, we consider 15 MHz of spectrum where more than 96 satellite channels spaced by 150 kHz can be accommodated. We assume here that these 96 channels are grouped into 16 FPUs (frequency pattern units), each one constituted by 6 contiguous satellite channels.

As an example, consider an ATC service region that has the SC covering the same region with FPUs 2, 7, 9, and 14. If the FPUs were assigned spectrum as shown in the top part of

Figure 1, then only three of the ATC channels would be candidates for increased capacity. On the other hand, if the FPUs were assigned spectrum as shown in the bottom of Figure 1, then seven ATC channels would potentially be available for increased use.

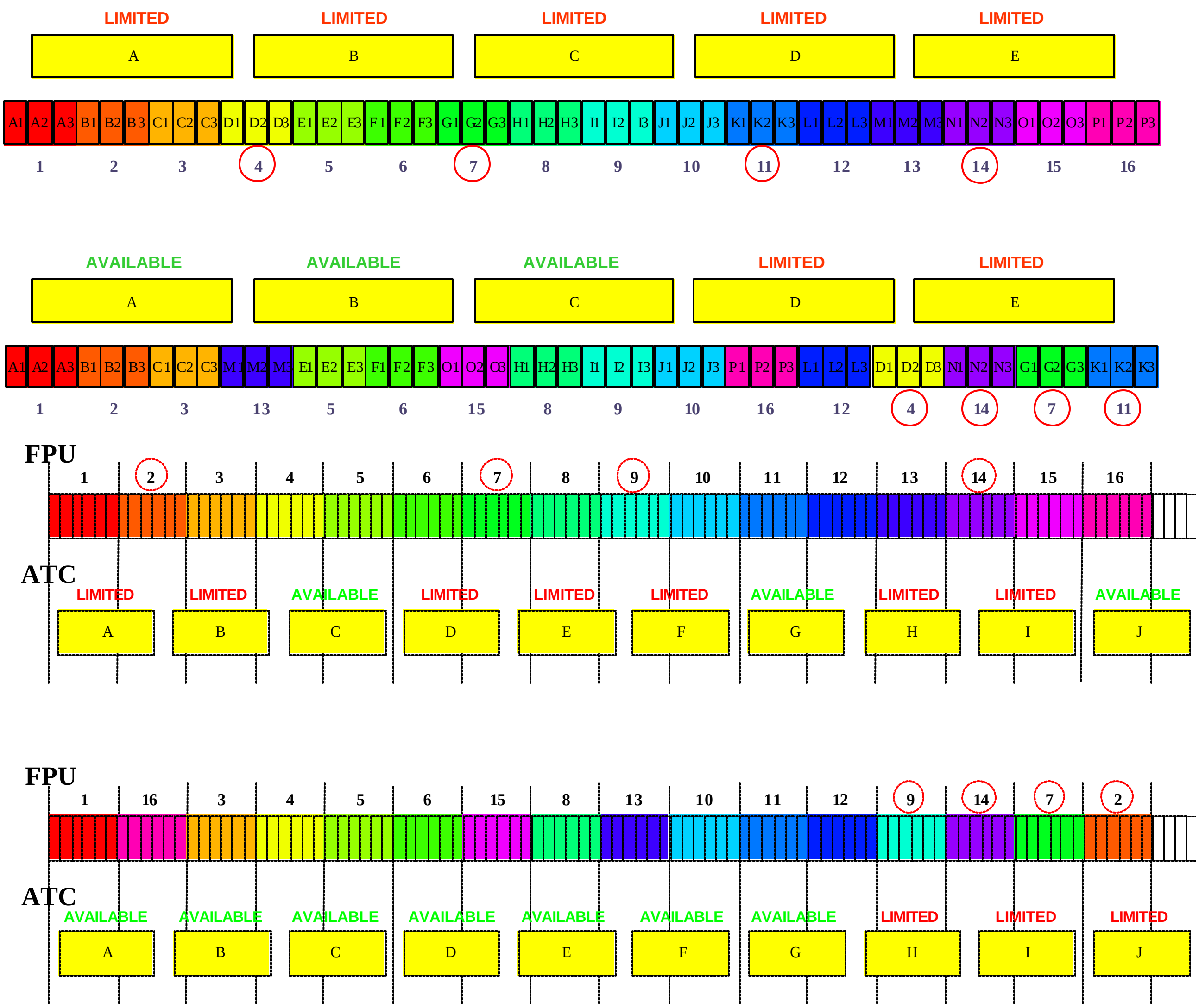

Figure 1. Conceptual SC/ATC Frequency Coordination Plan

Based on the optimum assignment of channels to beams – taking into account all beams from all satellites covering ATC service areas – simulations have indicated that a 50% net improvement in ATC capacity could be readily achievable without any impact on the SC capacity. An independent terrestrial operator, let alone many such operators, could not react in such a highly centralized environment.

If this effect is compounded with that described in the previous section, we conclude that, under the assumptions made here, the integrated operator would be able to serve over 1.6 million subscribers, an increase of about 175% with respect to the capability of the independent operator.

APPENDIX B

Overview of SC/ATC Dynamic Resource Management

A key advantage an integrated MSS operator[1] holds over an independent terrestrial CMRS operator seeking to share MSS spectrum is the ability to dynamically manage spectrum resources between satellite component (SC) and ancillary terrestrial component (ATC) delivery platforms. Permitting MSS operators to exploit this advantage is essential for achieving the most efficient use of the limited available MSS spectrum.

Paragraph 59 of the Commission's Notice of Proposed Rulemaking states in part, "ICO has maintained that its proposed architecture involves dynamic spectrum management not resulting in band segmentation. We seek comment [on] this assertion and whether ICO's [proposal] should be considered band segmentation, which might lead to an option of establishing terrestrial licenses for segmented spectrum for auction."

ICO has already developed the capability to manage spectrum dynamically for its satellite system. This appendix provides an overview of ICO's current dynamic resource management technology and also describes how that technology can be extended to include management of an integrated ATC.

A. ICO's Dynamic Satellite Resource Management System

ICO has already developed, built, and installed a dynamic Satellite Resource Management System (SRMS). The system consists of a central Satellite Resource Management Center (SRMC), which generates plans to configure all of the satellites and Satellite Access Nodes (SANs). Distribution of the plans to the satellites is performed by the Payload Command System (PCS). Distribution of the plans to the SANs is performed by a central server (Link-Satellite Resource Handler) and distributed servers (Satellite Access Node-Satellite Resource Management Systems -SAN-SRMS) at each SAN site.[2]

Dynamic radio resource planning and allocation is a feature required to operate an NGSO MSS system. This is because the satellite radio cells, or spot beams, move with respect to user equipment (UE) located on the ground. For example, the ICO spot beams move at about 1 degree (~100km) per minute with respect to a stationary point on Earth. The ICO SRMS produces resource allocation plans that vary minute by minute on a global basis.[3] As the ICO satellites circle the earth, these resource allocation plans configure the satellite transponders and the frequency ranges available in each satellite spotbeam, so that the SAN equipment can access

[1] For purposes of this appendix, an "integrated MSS" is defined as a network under the control of a single operator that provides services through both a satellite component (SC) and a ancillary terrestrial component (ATC).

[2] The SRMS was developed over a five-plus year period and is now installed. Over 500,000 lines of new computer code on a suite of HP-9000/K370 servers run the system.

[3] This fast-moving, dynamic reallocation is a stark contrast to terrestrial resource re-planning. Terrestrial resource re-planning rarely occurs because the radio cells are preplanned and are fixed with respect to user equipment (UE).

or release specific frequencies for communications. The specific frequencies contained in the time-varying frequency plans depend on: which frequencies are available in various geographic regions, SC traffic demands, location of the satellites and spotbeams with respect to the ground, the requirement to avoid self-interference and interfering with other services operating in 2 GHz bands, and coordination agreements with other MSS systems. All of this must be done dynamically or the MSS system will not be able to match resources to the user traffic demand.

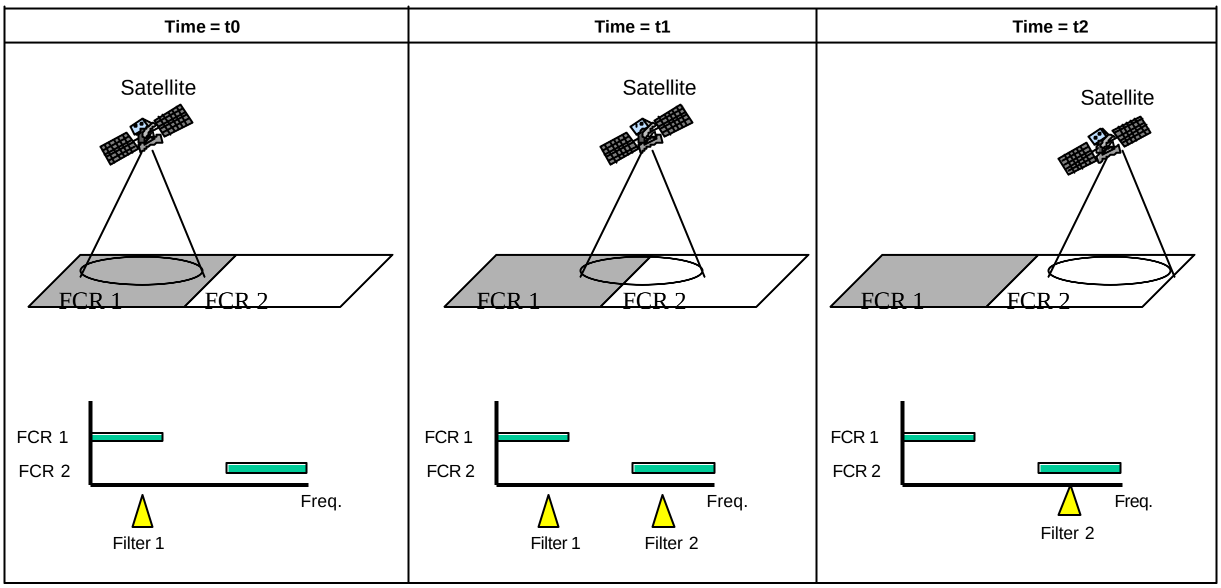

Figure 1. Dynamic resource management in the ICO system

Figure 1 depicts three different snap-shots in time of a satellite spotbeam coverage over 2 Frequency Co-ordination Regions (FCRs)[4]. At t0, the spotbeam is providing coverage to FCR1 only. FCR 1 has a specific frequency band available for communications and so satellite filter 1 is tuned to be within that frequency band. At t1, the spotbeam covers both FCR1 and FCR2. Since both FCRs have separate non-overlapping frequency bands, 2 satellite filters are required in that beam to support user traffic in each FCR. At t2, only 1 satellite filter is required to support the spotbeam coverage in FCR 2. As Figure 1 demonstrates, the motion of the spotbeam coverage with respect to the ground necessitates dynamic frequency planning. In practice, the ICO SRMS is far more complex because it has to manage the resource plans not just for one spotbeam, but for the 163 spotbeams of each of the 12 satellites, with each satellite completing an Earth orbit every 6 hours. The resource configuration at the SANs also needs to be dynamic so as to mirror the satellite configurations.

Attributes of ICO's SRMS. The ICO SRMS accomplishes a number of functions:

4 An FCR is a broad-scale geographic area over which the same spectrum is available for use by the satellite system.

- Global coverage planning;
    - This function determines for each timestep, which combination of satellite and SAN can provide the best coverage to each geographic region.
- Global traffic planning;
    - This function processes data on previously carried traffic and forecasts the traffic demand for each spotbeam as a function of time.
- Frequency planning;
    - This function determines which frequencies are assigned to each spotbeam as a function of time, so as to carry as much traffic as possible, while meeting various system and interference constraints.
- Power planning;
    - This function adjusts the resource plans so that the satellite and SAN power limitations are not violated.
- External interference management
    - This function permits the configuration of which frequencies are available and not available for each geographic region and each spotbeam.

The main outputs of the ICO SRMS are the following time-variant resource plans:

- Burst Time Frequency Plans (BTFP);[5]
- Satellite Channelization Plans (SCP)[6]; and
- SAN-satellite contact plans.[7]

5 BTFP are the resource plans used by each SAN. They define for each time-step a pool of frequencies and TDMA timeslots that are available in each spotbeam of each satellite in contact with that SAN.

6 The SCPs define for each time-step for each of satellite the filter and frequency assignment for each spotbeam. Note: The twelve satellites each encompass 163 separate beams tunable across 200 x 150 kHz S-band frequency slots and 490 x 150 kHz frequency filters per satellite

7 SAN-satellite contact plans are define which satellites are in contact with which SAN as a function of time.

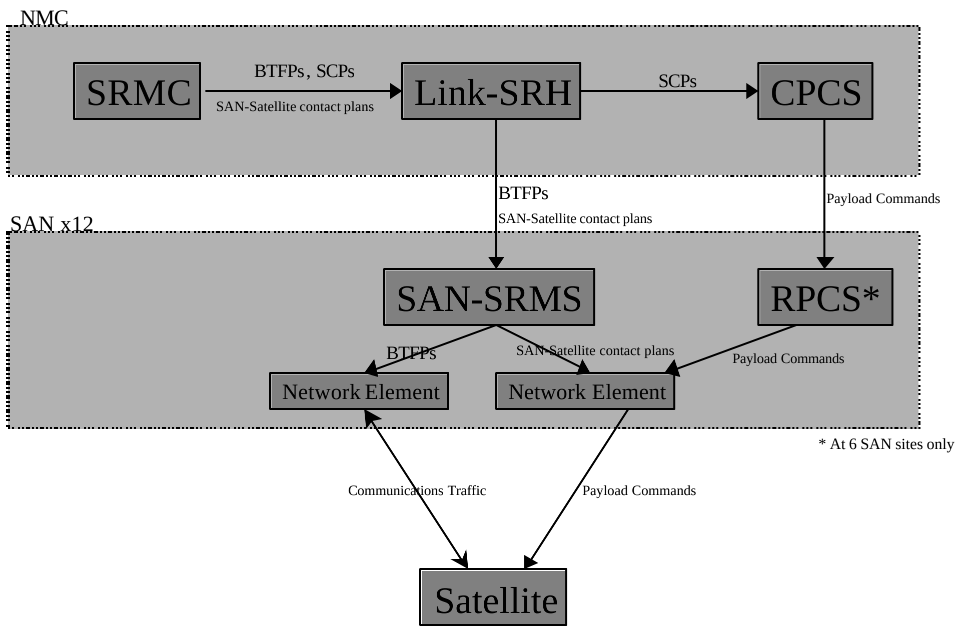

Figure 2: Resource Plan Distribution in the ICO system.

The SRMS distributes the BTFPs to each of the SANs (see figure 2). The SRMS uploads the SCPs to each of the satellites via the PCS, which comprises a Central PCS (CPCS) and six Remote PCS (RPCS) units. Normally each set of plans is valid for a 24-hour period, with the SRMS producing a new set of plans every day. However, if there is a contingency, triggered by for example traffic variations, or satellite or SAN outages, then the entire system resources can be replanned and reconfigured within 3 hours to cope with the contingency[8]

The SRMS produces resource plans based on a 1x1-degree grid of the global ground cells, taking as input the following system constraints:

- The global frequency allocations for each ground cell;
- 4 cell frequency re-use patterns;
- Satellite field-of-view constraints;
- Instantaneous available frequency;
- Traffic demands;
- Moving satellites/beams;
- Overlapping satellite beams; and
- The limited satellite power and available filters per satellite

What all of this shows is that dynamically and efficiently allocating resources, particularly spectrum resources, within a satellite system has already been realized.[9]

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8 The contingency resource plans are typically valid for 8 hours. However, this validity period is operator configurable.

9 Although ICO has successfully installed its central SRMS, producing resource plans is not an easy task. ICO's baseline algorithm evaluates for each time step, for each spot beam of each satellite the offered traffic versus the

Adding an ATC Component. The preceding description of ICO's existing SRMS illustrates the many parameters that must be evaluated to dynamically allocate resources so that the ICO satellite network can operate effectively. However, to operate viably, the system must compensate for satellite signal blockage problems. This requires an ATC segment to provide service to areas that cannot receive the ICO satellite signal. Using its dynamic resource management techniques, ICO can add an integrated ATC to its network and can share spectrum between ATC and SC.

It is well known that sharing spectrum between a separate terrestrial mobile network and a separate, pure MSS network is difficult to the point of being nearly impossible. It is also evident that using hard band segmentation between the two networks is no solution because that "technique" only results in the permanent assignment of the capacity to either MSS or Terrestrial system. However, by taking into account a number of constantly changing parameters, a single network operator would be able to use dynamic resource management to successfully integrate SC and ATC into a viable MSS network.

As described in the text on ICO's SRMS, ICO already has the hardware and software to use dynamic frequency management within its satellite component. To add ATC, ICO would develop and employ a centralized Dynamic Resource Management System (DRMS). The DRMS would shift frequencies between the SC and ATC according to traffic demands.

The DRMS would be an extension of the capabilities of the current ICO SRMS. At a high level, a Spectrum Sharing Manager (SSM) would take as input the traffic demands and resource planning constraints for both the SC and ATC parts of the system. It would then determine the time-varying spectrum requirements of the SC/ATC system. This would permit dynamic resource plans to be prepared and distributed to configure the SC and ATC parts of the system. At a lower level, a Spectrum Resource Dynamic Allocator (SRDA) would manage the dynamic sharing of spectrum between the ATC and SC components. The integrated dynamic resource management system would take into account each system's current use, ongoing demand, interference thresholds and other constraints to shift frequencies between the two resources – without interference and without needless, spectrum-inefficient hard band segmentation. The key to successfully managing the SC/ATC network will be new ATC traffic management mechanisms that take into account SC factors and that are controlled by one resource manager.[10]

ATC Traffic Management Mechanisms. Two potential traffic management methods are considered – a carrier on/off method and an admission control method. The carrier on/off method basically shifts spectrum between SC and ATC based on demand. As an initial matter,

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Continued …

available spectrum versus intra-system-inter-beam interference. Having done that, for each beam the system assigns frequency slots from a pool of satellite filters until all traffic is served. While doing this the system is constrained by the limited number of filters per satellite, a limitation on the maximum number of payload commands per second, a need to minimize frequency hopping and a need to maintain continuity for a particular frequency per beam for as long as possible.

[10] Conversely, based on current ATC factors, an enhanced ICO SRMS would dynamically manage SC frequency plans.

both the ATC and the SC will each maintain a nominal amount of spectrum for signaling and other functions. As ATC traffic increases, base stations are permitted to turn on additional carriers that are selected from the available frequencies in a shared (SC/ATC) pool. Conversely, as traffic decreases, base stations turn off unneeded carriers that are then returned to the shared pool. Figure 3 illustrates the on/off method.

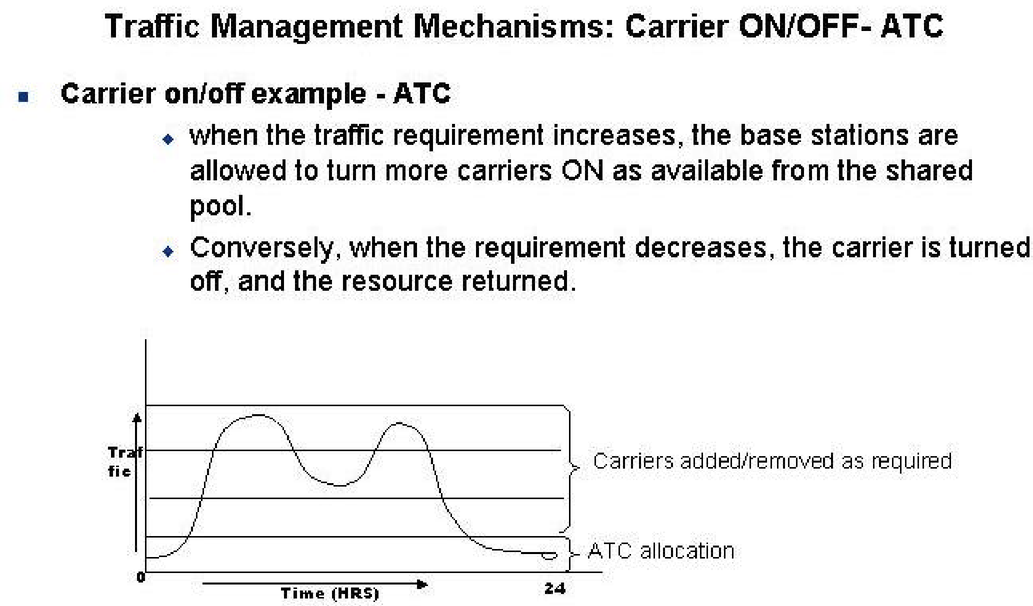

Figure 3. ATC Carrier On/Off Method

The admission control method manages spectrum that is used by both the SC and the ATC within the same satellite footprint. In the body of the main document to which this Appendix is attached, ICO noted that to prevent excessive interference to its SC, there is a limit on the number of active terrestrial users within the same satellite footprint.[11] In the admission control method both the ATC and the SC use shared spectrum until the SC interference threshold is approached.[12] As the number of active ATC users causes the SC interference threshold to be reached, a warning is sent to the SRDA. The SRDA would then route new ATC call requests to non-shared spectrum where spectrum would be granted, if available. Alternatively, the ATC call would be blocked to avoid harmful interference to the SC component.

B. Conclusion

ICO has already developed and installed an SRMS to operate its global NGSO MSS system. The same concepts ICO used to develop its SRMS apply to developing an extension of SRMS to manage ATC resources and SC/ATC resources. The key element to making SC/ATC work

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11 *See ante*, part IV.A; *see also* Appendix A.

12 The SC interference threshold could be nominally based on the SC's required C/I ratio.

successfully is a totally integrated SC/ATC resource management system. It is the *only* feasible way to permit significant terrestrial use of the 2 GHz MSS band. Figure 4 below is a reference model of an integrated system that might accomplish this.

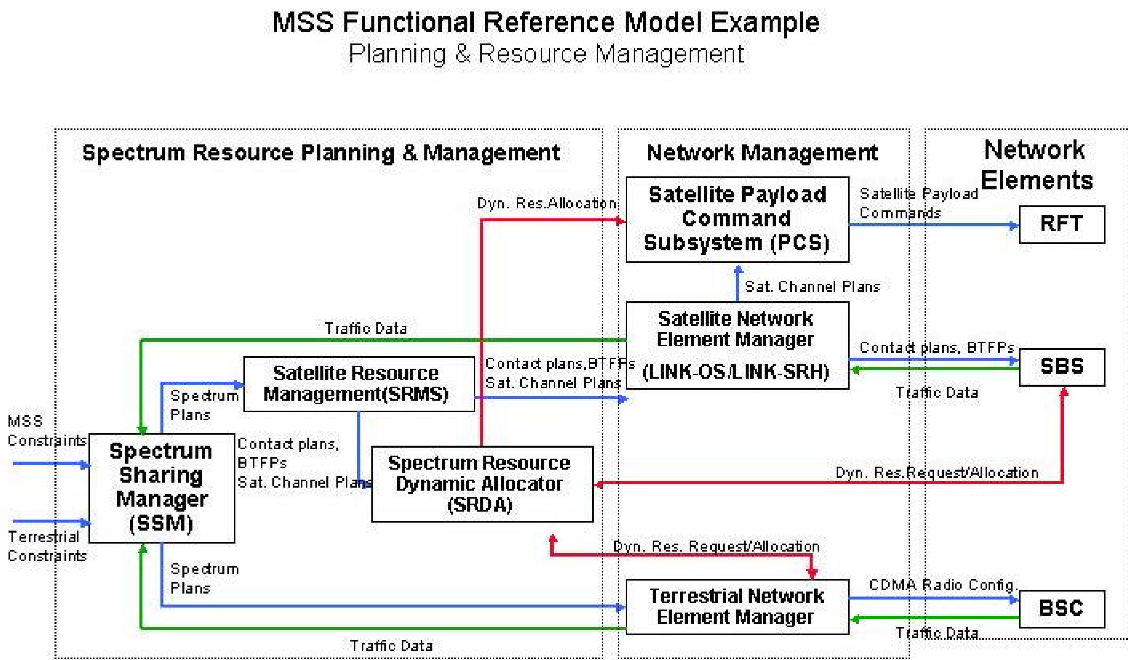

Figure 4. Integrated MSS Functional Reference Model Example